This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

B 431461

SECOND

Standardization Bulletin

by the

Standardization Division

of the

American Mining Congress

1922

629.05
A5
M66St/Inc

PROCEEDINGS

of the

Second National Standardization Conference

Held in Connection with
The Twenty-Fourth Annual Convention

of the

American Mining Congress

CHICAGO, ILLINOIS
OCTOBER 17-22, 1921

Published By
AMERICAN MINING CONGRESS
WASHINGTON, D. C., 1922

CRAFTSMEN PRINTERS, CHICAGO

CONTENTS

GENERAL

Page

Attendance at the Standardization Conference xii
Personnel of the Standardization Division vi
Report of Chairmen of the General Committees 1
Recommendations of the General Committees.
1. For Special Joint Co-ordinating Committee 1
2. Standard Method of Procedure ..... 2 and 141
Index of Speakers .....
Index of Addresses .....

PROCEEDINGS OF THE JOINT SESSIONS

General Subject: National and International Standardization
Addresses and Speakers

American Engineering Standards Committee, and National Standards, by A. A. Stevenson 117
Discussion 121
Industrial Standardization in Europe, by Dr. P. G. Agnew 122
Discussion 127
Government Interest in Standardization for Mining Industry, by Prof. E. A. Holbrook 128
Discussion 131

General Subject: Commercial View of Standardization
Addresses and Speakers

Safety and Standards, by S. J. Williams 144
Discussion 149
Standardizing Research Results Through Public Information, by C. R. Thomas 150
Discussion 159
Benefits of Standardization as Reflected by Insurance Rates, by C. B. Butterfield 160
Discussion 167
The Standardization Movement in Canada, by E. J. Durley 168
National Co-ordination of Standardization Through the General Correlating Committee, by Col. Warren R. Roberts 175

General Subject: Co-operation of Government and Industry in Standardization
Addresses and Speakers
Chairman: Col. Warren R. Roberts

Co-operation of the Department of Commerce with the Mining Industry, by the Hon. Herbert Hoover, read by H. C. Morris 259
Standardization as a Factor in Stabilization of the Coal Industry, by C. E. Lesher 261
Standardization and National Defense, by Col. Geo. S. Gibbs 265
Announcements and Remarks, by J. F. Callbreath 271

CONTENTS

METAL MINING BRANCH

Page

Opening Meeting of Metal Mining Branch 181

Report of Chas. A. Mitke, General Chairman 181

Progress Report of Committee on Underground Transportation—William B. Daly, Chariman 231

Discussion of Report 257

Progress Report of Committee on Mechanical Loading Underground —Lucien Eaton, Chairman 183

Progress Report of Committee on Fire-fighting Equipment—William Conibear, Chairman 183

Discussion of Report 184

Progress Report of Committee on Drilling Machines and Drill Steel—Norman B. Braly, Chairman 186

Chart forming part of this Report 191

The Effect of Cartridge Diameter on the Strength and Quickness of High Explosives, by Chas. S. Hurter 192

Standardization of Drilling Machines and Drill Steel, by George H. Gilman 198

Progress Report of Committee on Steam Shovel Equipment—H. C. Goodrich, Chairman 206

Progress Report of Committee on Mine Ventilation—Chas. A. Mitke, Chairman 207

Discussion of Report 210

Progress Report of Committee on Mine Timbering—Gerald Sherman, Chairman 210

General Resume of data obtained from questionnaires sent to various companies 215

Discussion of data obtained from questionnaires, by General Chairman Chas. A. Mitke 221

Mine Timber Preservation, by R. R. Horner and George M. Hunt 224

Progress Report of Committee on Mine Accounting—T. O. McGrath, Chairman 227

Discussion of Report 230

CONTENTS

COAL MINING BRANCH

Page

Recommendations and Reports of the Committees and Discussions

Mine Drainage—E. D. Knight, Chairman 11

Discussion 23

Outside Coal Handling Equipment—Dr. H. M. Payne, Chairman ... 27

Discussion 28

Mine Ventilation—Wm. J. Montgomery, Chairman 29

Discussion 39

Underground Transportation—C. E. Watts, Chairman 44

Sub-Committee on Mine Locomotives—Graham Bright, Chairman 45

Sub-Committee on Mine Tracks and Signals—Fred Norman, Chairman 49

Sub-Committee on Design and Construction of Mine Cars—Colonel J. Milliken, Chairman 46

Discussion of Sub-Committee Reports 70

Joint Report on Underground Power Transmission and Power Equipment—A. B. Kiser and K. A. Pauly, Chairmen 73

Discussion 99

Underground Loading and Cutting Machines—C. A. Cabell, Chairman 99

Discussion 99

ORGANIZATION OF STANDARDIZATION DIVISION

COAL MINING BRANCH

General Committee

COLONEL WARREN R. ROBERTS, *Chairman*, Chicago, Illinois.

E. D. KNIGHT, Cabin Creek Cons. Coal Co., Kayford, W. Va.

C. E. WATTS, Efficiency Engineer, Berwind-White Coal Mining Company, Windber, Pa.

A. B. KISER, Electrical Engineer, Pittsburgh Coal Co., Pittsburgh, Pa.

W. J. MONTGOMERY, Manager, Ventilating Dept., Jeffrey Manufacturing Co., Columbus, Ohio.

K. A. PAULY, Power & Mining Engineering Dept., General Electric Co., Schenectady, N. Y.

C. A. CABELL, V. P., Carbon Fuel Company, Kanawha National Bank Bldg., Charleston, W. Va.

DR. HENRY MACE PAYNE, Andrade-Eyre, Inc., 300 Madison Avenue, New York City.

Underground Transportation

C. E. WATTS, *Chairman*

CHARLES M. MEANS, Consulting Engineer, Pittsburgh, Pa.

GRAHAM BRIGHT, Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa.

JOSEPH BRYAN, General Electric Co., Pittsburgh, Pa.

F. C. COSEO, Jeffrey Manufacturing Co., Columbus, Ohio.

D. F. LEPLEY, General Manager, Connellsville Manufacturing & Supply Co., Connellsville, Pa.

E. A. WATTERS, General Supt., Hicks' Coal Companies, Leechburg, Pa.

J. MILLIKEN, President Industrial Car Mfrs. Inst., Pittsburgh, Pa.

A. H. EHLE, General Sales Manager, Baldwin Locomotive Works, Philadelphia, Pa.

H. K. PORTER, Mine Car Department, Hyatt Roller Bearing Co., New York City.

FRANK S. BARKS, President, Lincoln Steel & Forge Co., St. Louis, Mo.

FRED NORMAN, Chief Engineer, Allegheny River Mining Co., Kittanning, Pa.

T. A. PARKER, Manager, Mine Car and Equipment Dept., St. Louis Structural Steel Co., St. Louis, Mo.

Mining and Loading Equipment

C. A. CABELL, *Chairman*

D. J. CARROLL, Chicago, Wilmington & Franklin Coal Co., Benton, Ill.

E. N. ZERN, Mining Engineer and Editor "Mining Catalog," Pittsburh, Pa.

CARL SCHOLZ, General Manager, Raleigh-Wyoming Coal Co., Charleston, W. Va.

N. D. LEVIN, Jeffrey Manufacturing Co., Columbus, Ohio.

J. M. CLARK, Clark & Krebs, Charleston, W. Va.

M. MITCHELL, Sullivan Machinery Co., St. Louis, Mo.

WILLIAM WHALEY, Myers-Whaley Co., Knoxville, Tenn.

WM. O. DUNTLEY, Duntley-Dayton Co., Chicago, Ill.

E. S. MCKINLEY, 625 Denham Bldg., Denver, Colo.

WM. E. HAMILTON, 310 Schultz Bldg., Columbus, Ohio.

WALTER STEVENS, Valier Coal Co., Valier, Ill.

S. W. FARNHAM, Mining Engineer, Goodman Mfg. Co., Chicago, Ill.

E. K. BOWERS, Morgan-Gardner Electric Co., Chicago, Ill.

COMMITTEES

Drainage

E. D. KNIGHT, *Chairman*

M. C. BENEDICT, Consulting Engineer, Johnstown, Pa.
WALTER D. STOCKLEY, Fairmont, W. Va.
E. F. AUSTIN, Manager, Mine Pump Dept., Dravo-Doyle Co., Pittsburgh, Pa.
CECIL W. SMITH, Mining Engineer, Nokomis Coal Co., Old Colony Building, Chicago, Ill.
F. W. SMITH, Mine Drainage Engineer, Weinman Pump & Supply Co., Pittsburgh, Pa.
F. J. EMENY, Chief Engineer, The Deming Company, Salem, Ohio.
PROFESSOR JOHN W. HALLOCK, Head of Department of Industrial Engineering, University of Pittsburgh, Pittsburgh, Pa.
R. Y. WERT, Mine Drainage Supt., Durham Coal & Iron Co., Soddy, Tenn.
J. H. EDWARDS, Electrical Engineer, Elkhorn Piney Coal Mining Co., Huntington, W. Va.
L. D. TRACY, Mining Engineer, U. S. Bureau of Mines, Pittsburgh, Pa.
M. SPILLMAN, Worthington Pump and Machinery Co., Harrison, N. J.
ROSCOE N. WOLTZ, Electrical Engineer, Stonega Coal and Coke Co., Big Stone Gap, Va.
HENRY E. COLE, Harris Pump and Supply Co., 320 Second Avenue, Pittsburgh, Pa.

Ventilation

W. J. MONTGOMERY, *Chairman*

J. M. DOUGHTY, Lehigh & Wilkes-Barre Coal Co., Wilkes-Barre, Pa.
HOWARD N. EAVENSON, Mining Engineer, Union Arcade Bldg., Pittsburgh, Pa.
MARTIN J. LIDE, Birmingham, Ala.
G. E. LYMAN, Genl. Supt., Madison Coal Corporation, Glen Carbon, Ill.
E. N. ZERN, Mining Engineer and Editor "Mining Catalog," Pittsburgh, Pa.
J. C. GASKILL, Consolidation Coal Co., Fairmont, W. Va.
C. E. SHARPLESS, Engineer, Ebensburg Coal Co., Ebensburg, Pa.
E. B. WAGNER, Lehigh Valley Coal Co., Wilkes-Barre, Pa.
H. BERT WRIGHT, Pocahontas Fuel Co., Pocahontas, Va.

Outside Coal Handling Equipment

HENRY MACE PAYNE, *Chairman*

G. F. OSLER, G. S., Carnegie Coal Co., Pittsburgh, Pa.
W. A. BISHOP, G. S., Pocahontas Cons. Collieries, Pocahontas, Va.
F. W. WHITESIDE, Chief Engineer, Victor American Fuel Co., Denver, Colo.
JAS. NEEDHAM, General Manager, St. Paul Coal Co., Chicago, Ill.
F. G. MORRIS, G. S. Coal Mines, Republic Iron & Steel Co., Sayreton, Ala.
W. J. PATTERSON, President, Heyl & Patterson Co., Pittsburgh, Pa.
M. A. KENDALL, Chief Engineer, Stephens-Adamson Mfg. Co., Aurora, Ill.
WARREN R. ROBERTS, Wrigley Building, Chicago, Ill.
RUDOLPH H. KUDLICH, Asst. to Chief Mechanical Engineer, U. S. Bureau of Mines, Washington, D. C.

Underground Power Transmission

A. B. KISER, *Chairman*

HARRY M. WARREN, Electrical Engineer, D., L. & W. R. R., Scranton, Pa.
W. A. CHANDLER, care of Hudson Coal Co., Scranton, Pa.
R. L. KINGSLAND, General Superintendent, P. & M. Dept., Cons. Coal Co., Fairmount, W. Va.
CARL LEE, Electrical Engineer, Peabody Coal Co., McCormick Building, Chicago, Ill.
L. C. ILSLEY, 4800 Forbes St., Pittsburgh, Pa. (Bureau of Mines).

Power Equipment

K. A. PAULEY, *Chairman*

D. C. MCKEEHAM, Box 913, Union Pacific Coal Co., Rock Springs, Wyo.
G. S. THOMPSON, Colorado Fuel & Iron Co., Pueblo, Colo.
H. F. RANDOLPH, Cons. Engr., 2330 Oliver Bldg., Pittsburgh, Pa.

M. D. KIRK, Pittsburgh Terminal R. R. Coal Co., Wabash Bldg., Pittsburgh, Pa.
R. W. E. MOORE, Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa.
R. L. KINGSLAND, Consolidated Coal Co., Fairmont, W. Va.
W. C. SHUNK, Stonega Coal & Coke Co., Big Stone Gap, Va.
J. T. JENNINGS, Philadelphia & Reading Coal & Iron Co., Pottsville, Pa.
W. C. ADAMS, with Allen & Garcia, Chicago, Ill.
O. P. HOOD, Chief Mechanical Engineer, Bureau of Mines, Washington, D. C.
GRAHAM BRIGHT, Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.
A. J. NICHT, Allis-Chalmers Co., Milwaukee, Wis.
STEPHEN H. GREEN, Pacific Coast Coal Co., Seattle, Wash.
CHARLES LEGRAND, Phelps Dodge Corp., Douglas, Ariz.
MARTIN J. LIDE, Cons. Engr., Birmingham, Ala.
C. D. WOODARD, Chief Electrical Engineer, Anaconda Copper Mining Co., Butte, Mont.

Advisory Committee on Safety Codes

S. W. FARNHAM, Goodman Manufacturing Co., Chicago, Ill.—Representing Mining and Loading Equipment.
T. A. PARKER, St. Louis Structural Steel Co., St. Louis, Mo.—Representing Underground Transportation.
MARTIN J. LIDE, Consulting Engineer, Birmingham, Ala.—Representing Power Equipment.
A. B. KISER, Pittsburgh Coal Co., Pittsburgh, Pa.—Representing Underground Power Transmission.
G. F. OSLER, Carnegie Coal Co., Pittsburgh, Pa.—Representing Outside Coal Handling Equipment.

METAL MINING BRANCH

General Committee

CHARLES A. MITKE, Bisbee, Ariz., *Chairman*
A. B. BRALY, General Manager, North Butte Mining Co., 14 W. Granite St., Butte, Mont.
WILLIAM B. DALY, Asst. General Manager, Anaconda Copper Company, Butte, Mont.
WILLIAM CONIBEAR, Inspector, Dept. of Safety, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
H. C. GOODRICH, 1408 Deseret Bank Bldg., Salt Lake City, Utah.
GERALD SHERMAN, Care Phelps Dodge Corp., Douglas, Ariz.
LUCIEN EATON, Superintendent, Ishpeming District, Cleveland-Cliffs Iron Company, Ishpeming, Mich.
T. O. MCGRATH, Shattuck Arizona Mining Co., Bisbee, Ariz.
CHAS. F. WILLIS, Editor, Arizona Mining Journal, Phoenix, Ariz.

Drilling Machinery and Drill Steel

N. B. BRALY, *Chairman*
ARTHUR B. FOOTE, North Star Mines, Grass Valley, Calif.
ARTHUR NOTMAN, Superintendent, Mine Dept., Copper Queen Br., Phelps Dodge Corp., Bisbee, Ariz.
O. J. EGGLESTON, Manager, U. S. Smelting, Refining & Mining Co., Kennett, Calif.
ARTHUR CRANE, Explosive Expert, Hercules Powder Co., San Francisco, Cal.
G. S. ELAYER, General Foreman, Arizona Commercial Mining Co., Globe, Ariz.
J. A. FULTON, Idaho-Maryland Mines Co., Grass Valley, Cal.
L. C. BAYLES, Chief Engineer, Ingersoll-Rand Co., Phillipsburg, N. J.
H. SEAMON, Efficiency Engineer, United Verde Copper Co., Jerome, Ariz.

OCHA POTTER, Superintendent, Superior Division, Calumet and Hecla Mining Co., Houghton, Mich.
R. T. MURRILL, Inspiration Cons. Copper Co., Inspiration, Ariz.
GEORGE H. GILMAN, 125 Prescott Street, East Boston, Mass.
CHARLES LEES, Superintendent, Iron Cap Copper Co., Copper Hill, Ariz.
CHARLES A. SMITH, Mine Superintendent, Ray Cons. Copper Co., Ray, Ariz.
ROY MARKS, Stope Engineer, Box 1676, United Verde Exten. Mining Co., Jerome, Ariz.
EARL HASTINGS, Foreman, Clay Mine, Arizona Copper Co., Ltd., Morenci, Ariz.
FRANK AYER, Mine Superintendent, Montezuma Copper Co., Pilares De Nacozari, Sonora, Mexico.
W. G. SCOTT, Superintendent, Coronado Mines, Arizona Copper Co., Ltd., Metcalf, Ariz.
THOS. C. BAKER, Asst. General Manager, The Mexican Corporation, Edificio, La Mutua, Mexico City, Mexico.
CHARLES OFFICER, Sullivan Machinery Co., Chicago, Ill.
A. S. UHLER, Ingersoll-Rand Co., New York City.
GEORGE D. SHAW, Efficiency Engineer, Denver Rock Drill Manufacturing Co., Denver, Colo.
H. T. WALSH, V. P., Sullivan Machinery Co., Chicago, Ill.
R. A. SCOTT, S. M., Denver Rock Drill Mfg. Co., Denver, Colo.
BRUCE YATES, Homestake Mining Co., Lead, S. D.

Inner Committee

Drilling Machines and Drill Steel

FRANK AYER, Superintendent, Montezuma Copper Co., Nacozari, Sonora, Mexico.
H. SEAMON, Drill Efficiency Engineer, United Verde Copper Co., Jerome, Ariz.
CHARLES A. SMITH, Superintendent, Ray Cons. Copper Co., Ray, Ariz.
ARTHUR NOTMAN, Superintendent, Copper Queen Br., Phelps Dodge Corp., Bisbee, Ariz.
GEORGE GILMAN, 125 Prescott St., East Boston, Mass.
H. T. WALSH, Vice-President, Sullivan Machinery Co., Chicago, Ill.
GEORGE A. SHAW, Efficiency Engineer, Denver Rock Drill Manufacturing Co., Denver, Colo.
L. C. BAYLES, Chief Engineer, Ingersoll-Rand Co., Phillipsburg, N. J.

Underground Transportation

WILLIAM B. DALY, *Chairman*

GEORGE H. BOOTH, Mechanical Engineer, Inspiration Cons. Copper Co., Inspiration, Ariz.
ANDOVER SYVERSON, Chief Engineer, United Verde Exten. Mining Co., Jerome, Ariz.
E. M. MORRIS, Asst. Supt. of Mines, Anaconda Copper Mining Co., of Butte, Mont.
R. R. BOYD, Asst. Superintendent Mine Dept., Copper Queen Branch, Phelps Dodge Corp., Bisbee, Ariz.
T. K. SCOTT, Chief Engineer, Box 100, Miami Copper Co., Miami, Ariz.
H. T. HAMILTON, Manager, Montezuma Copper Co., Nacozari, Sonora, Mexico.
R. E. HOWE, Asst. General Manager, Cananea Cons. Copper Co., Cananea, Sonora, Mexico.
D. S. CALLAND, Managing Director, Compania de Real del Monte de Pachuca, Pachuca, Hidalgo, Mexico.

Fire Fighting Equipment

WILLIAM CONIBEAR, *Chairman*

J. T. YOUNG, Safety Inspector, Arizona Copper Company, Morenci, Ariz.
ORR WOODBURN, Safety First Director, Globe-Miami District, Globe, Ariz.

COMMITTEES

A. A. KROGDAHL, Safety Engineer, Oliver Iron Mining Co., Virginia, Minn.
GUY J. JOHNSON, Safety Engineer, Homestake Mining Company, Lead, S. D.
H. J. RAHILLY, Superintendent, Mine Fire and Hydraulic Filling Dept., Anaconda Copper Mining Company, Butte, Mont.

Steam Shovel Equipment

H. C. GOODRICH, *Chairman*

ROBERT E. TALLY, General Superintendent, United Verde Copper Company, Clarkdale, Ariz.
G. W. BARNHART, Manager, San Francisco Branch, Marion Steam Shovel Co., San Francisco, Calif.
C. B. LAKENAN, General Manager, Nevada Cons. Copper Co., McGill, Nev.
H. G. S. ANDERSON, Mining and Metallurgical Engineer, Hurley, N. Mex.

Mine Ventilation

CHARLES A. MITKE, *Chairman*

A. C. STODDARD, Chief Engineer, Inspiration Cons. Copper Co., Box 15, Inspiration, Ariz.
WALTER C. BROWNING, General Manager, Magma Copper Co., Superior, Ariz.
NORMAN G. HARDY, Chief Mechanical Engineer, Smelter Dept., Arizona Copper Co., Clifton, Ariz.
W. A. ROWE, Chief Engineer, American Blower Co., Detroit, Mich.
E. B. WILLIAMS, Manager, Mine Fan Dept., B. F. Sturtevant Company, Hyde Park, Boston, Mass.
ROBERT N. BELL, Boise, Idaho.
F. L. STONE, care General Electric Co., Schenectady, N. Y.
C. E. LEGRAND, Consulting Engineer, Phelps Dodge Corp., Douglas, Ariz.
O. K. DYER, Buffalo Forge Company, Buffalo, N. Y.
DON M. RAIT, Asst. Superintendent of Mines, Calumet and Arizona Mining Co., Warren, Ariz.
A. S. RICHARDSON, Chief of Ventilating Department, Anaconda Copper Mining Co., Drawer 1375, Butte, Mont.

Mechanical Loading Underground

LUCIEN EATON, *Chairman*

H. E. BILLINGTON, Manager of Sales, The Thew Shovel Co., Lorain, Ohio.
J. H. HENSLEY, Mine Superintendent, Miami Copper Company, Miami, Ariz.
ALBIN F. VICTOR, Manager of Sales, Lake Superior Loader Co., Duluth, Minn.
H. DEWITT SMITH, Superintendent of Mines, United Verde Copper Co., Jerome, Ariz.
WILLIAM WHALEY, General Manager, Myers-Whaley Co., Knoxville, Tenn.
R. W. MACFARLANE, Mining Dept., Longfellow Div., Arizona Copper Co., Morenci, Ariz.

Mine Timber

GERALD SHERMAN, *Chairman*

W. G. MCBRIDE, General Manager, Old Dominion Co., Globe, Ariz.
IRA B. JORALEMON, Asst. General Manager, Calumet & Arizona Mining Co., Warren, Ariz.
FELIX MCDONALD, Mines Superintendent, Inspiration Cons. Copper Co., Inspiration, Ariz.
JOHN KIDDIE, Division Superintendent, Arizona Copper Company, Morenci, Ariz.

COMMITTEES

W. S. BOYD, Manager, Ray Cons. Copper Co., Ray, Ariz.
T. EVANS, General Supt., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.
C. L. BERRIEN, Gen. Supt., Anaconda Copper Co., Butte, Mont.

Mine Accounting

T. O. MCGRATH, *Chairman*
L. S. CATES, General Mgr., Utah Copper Co., Salt Lake City, Utah.
J. C. DICK, Salt Lake City, Utah.
H. H. MILLER, General Auditor, Hercules Mining Co., Wallace, Idaho.
H. L. NORTON, Phelps Dodge Corporation, Douglas, Ariz.
HARRY VIVIAN, Chief Engineer, Calumet and Hecla Mining Co., Calumet, Mich.
L. K. DIFFENDERFER, Treas., Vanadium Corp., 120 Broadway, New York City, N. Y.

ATTENDANCE

Second National Standardization Conference

A

Adams, Gale L. ..... Elizabeth, N. J.

Adams, W. C. ..... Chicago, Ill.
Allen & Garcia,
Member of Committee on Power Equipment.

Agnew, Dr. P. G. ..... New York City, N. Y.
Secretary American Engineering Standards Committee.

Alcock, George W. ..... New York City, N. Y.

Austin, E. F. ..... Pittsburgh, Pa.
Manager Mine Pump Department, Dravo-Doyle Company,
Member of Committee on Mine Drainage.

B

Barks, F. S. ..... St. Louis, Mo.
President Lincoln Steel & Forge Company,
Member of Committee on Underground Transportation.

Beam, John W. ..... Denver, Colo.

Beatty, Alvin ..... Denver, Colo.

Becker, Ralph C. ..... Chicago, Ill.
Vice-President Keystone Consolidated Publishing Company.

Bell, Hubb ..... New York City
American Society of Testing Materials.

Benedict, M. C. ..... Johnstown, Pa.
Consulting Engineer,
Member of Committee on Mine Drainage.

Billington, H. E. ..... Lorain, Ohio
Manager of Sales, The Thew Shovel Company,
Member of Committee on Mechanical Loading Underground.

Blanchard, J. H. ..... Chicago, Ill.

Bright, Graham ..... East Pittsburgh, Pa.
Westinghouse Electric & Manufacturing Company,
Member of Committee on Underground Transportation.

Butterfield, C. B. ..... Hartford, Conn.
Manager The Associated Companies.

C

Callbreath, J. F. ..... Washington, D. C.
Secretary The American Mining Congress.

Calverly, W. R. ..... Pittsburgh, Pa.
General Manager Union Collieries Company.

Colbert, C. L. ..... Pittsburgh, Pa.
United States Bureau of Mines.

Cole, H. E. ..... Pittsburgh, Pa.
Member of Committee on Mine Drainage.

Coombes, Mrs. E. R.....Washington, D. C.
Assistant to Secretary The American Mining Congress.

Coseo, F. C.....Columbus, Ohio
Jeffrey Manufacturing Company,
Member of Committee on Underground Transportation.

Curry, J. E.....Bisbee, Ariz.

D

Daly, Wm. B.....Butte, Mont.
Assistant General Manager Anaconda Copper Company.
Chairman Committee on Underground Transportation.

Davis, M. T. Jr.....Charleston, W. Va.

Day, Edw. B.....Philadelphia, Pa.
Vice-President Keystone Consolidated Publishing Company.

Dyer, O. K.....Buffalo, N. Y.
Buffalo Forge Company.
Member of Committee on Mine Ventilation.

Duncan, W. G. Jr.....Greenville, Ky.
Chief Engineer W. G. Duncan Coal Company.

Durley, E. J.....Ottawa, Canada
Secretary Canadian Engineering Standards Association.

Diffenderfer, L.....New York City, N. Y.
Member of Committee on Mine Drainage.

E

Edwards, J. H.....Huntington, W. Va.
Electrical Engineer Elkhorn Piney Coal Mining Company.
Member of Committee on Mine Drainage.

Emeny, F. J.....Salem, Ohio
Chief Engineer The Deming Company.
Member of Committee on Mine Drainage.

F

Farnham, S. W.....Chicago, Ill.
Mining Engineer Goodman Manufacturing Company,
Member of Committee on Mining and Loading Equipment.

Fagan, F. D.....Orange, N. J.

G

Gibbs, Colonel George S.....Washington, D. C.
General Staff, War Department

Gilman, G. H.....East Boston, Mass.
Member of Committee on Drilling Machines and Drill Steel.

Griftner, J. H.....Champaign, Ill.
The Associated Companies.

H

Hitchner, A. E.....Pittsburgh, Pa.

Harrington, George B.....Chicago, Ill.
President C. W. & F. Coal Company.

R

Rae, J. C.....Gebo, Wyo.
Chief Engineer Owl Creek Coal Company.

Rice, George S.....Washington, D. C.
Chief Engineer Bureau of Mines.

Roberts, Colonel Warren R.....Chicago, Ill.
President Roberts & Schaefer Company,
Chairman General Committee, Standardization Division, Coal Mining Branch.

Rowell, H. C.....Chicago, Ill.
Western Manager Coal Age.

Ryan, W. D.....Kansas City, Mo.

S

Sanborn, R. P.....Orange, N. J.

Sanford, H. W.....Knoxville, Tenn.
Sanford-Day Company.

Scott, R. A.....Denver, Colo.
Sales Manager Denver Rock Drill Manufacturing Company,
Member of Committee on Drilling Machines and Drill Steel.

Simpson, W. E.....Chicago, Ill.
Car Dumper and Equipment Company.

Smith, F. W.....Pittsburgh, Pa.
Weinman Pump & Supply Company,
Member of Committee on Mine Drainage.

Stoek, Prof. H. H.....Urbana, Ill.
University of Illinois.

Stone, F. L.....Schenectady, N. Y.
General Electric Company.

T

Traer, G. W.....Chicago, Ill.

Thacher, Arthur M.....St. Louis, Mo.

Thomas, C. R.....Chicago, Ill.
Editor Professional Engineer.

Thompson, G. S.....Pueblo, Colo.
Colorado Fuel and Iron Company,
Member of Committee on Power Equipment.

Trick, C. H.....Columbus, Ohio
Jeffrey Manufacturing Company.

U

Uhler, A. S.....New York City, N. Y.
Ingersoll-Rand Company,
Member of Committee on Drilling Machines and Drill Steel.

V

Vaughn, L. C.....Morgantown, W. Va.

W

Walsh, H. T. ..... Chicago, Ill.
V. P. Sullivan Machinery Company,
Member of Committee on Drilling Machines and Drill Steel.

Ward, J. M. ..... Washington, D. C.

Wert, R. Y. ..... Soddy, Tenn.
Mining Engineer Durham Coal and Iron Company,
Member of Committee on Mine Drainage.

Whaley, Wm. ..... Knoxville, Tenn.
General Manager Myers-Whaley Company,
Member of Committee on Mining and Loading Equipment.
Member of Committee on Mechanical Loading Underground.

Williams, E. B. ..... Boston, Mass.
Mine Fan Department Manager B. F. Sturtevant Company,
Member of Committee on Mine Ventilation.

Williams, H. C. ..... Westborne, Tenn.
President and General Manager Campbell Coal Mining Company.

Williams, S. J. ..... Chicago, Ill.
Chief Engineer National Safety Council.

Willis, Chas. F. ..... Phoenix, Ariz.
Editor Arizona Mining Journal.

INDEX OF ADDRESSES

Page

Co-operation of the Department of Commerce with the Mining Industry—Hon. Herbert Hoover 259

Standardization and National Defense—Col. Geo. S. Gibbs 265

Standardization as a Factor in the Stabilization of the Coal Industry—C. E. Lesher 261

Announcements and Remarks—J. F. Callbreath 271

American Engineering Standards Committee and National Standards—A. A. Stevenson 117

Industrial Standardization in Europe—Dr. P. G. Agnew 122

Government Interest in Standardization for the Mining Industry—Prof. E. A. Holbrook 128

Safety and Standards—S. J. Williams 144

Standardizing Research Results Through Public Information—C. R. Thomas 150

Benefits of Standardization as Reflected by Insurance Rates—C. B. Butterfield 160

Standardization Movement in Canada—E. J. Durley 168

National Co-ordination of Standardization Through the General Correlating Committee—Col. Warren R. Roberts 175

INDEX OF SPEAKERS

Page

Dr. P. G. Agnew—Secretary American Engineering Standards Committee, New York City 122

C. B. Butterfield—Manager Associated Companies, Hartford, Conn... 160

J. F. Callbreath—Secretary American Mining Congress, Washington, D. C. 271

E. J. Durley—Secretary Canadian Engineering Standards Association, Ottawa, Canada 168

Col. Geo. S. Gibbs—General Staff, United States War Department, Washington, D. C. 265

E. A. Holbrook—Assistant Director, United States Bureau of Mines, Washington, D. C. 128

Herbert Hoover—Secretary, Department of Commerce 259

C. E. Lesher—Managing Editor of "Coal Age," New York City 261

H. C. Morris—Chief of Fuel Division, Department of Commerce, Washington, D. C. 259

Colonel Warren R. Roberts—President Roberts & Schaefer Co., Chicago, Ill. 175

A. A. Stevenson—President American Engineering Standards Committee, New York City 117

C. R. Thomas—Editor of "Professional Engineer," Chicago, Ill 150

S. J. Williams—Secretary and Chief Engineer, National Safety Council, Chicago, Ill. 144

JOINT SESSION COAL AND METAL MINING BRANCHES—STANDARDIZATION DIVISION

MONDAY, OCTOBER 17, 1921—11:00 A. M.

CHAIRMEN

COL. WARREN R. ROBERTS

Chairman of the General Committee of the Coal Mining Branch

and

MR. CHARLES A. MITKE

Chairman of the General Committee of the Metal Mining Branch

The Second National Standardization Conference, held in connection with the Twenty-fourth Annual Convention of The American Mining Congress, was called to order Monday, October 17, 1921, at eleven a. m., at the Hotel Congress, Chicago, Colonel Warren R. Roberts, presiding.

CHAIRMAN ROBERTS: I am going to give you a brief outline of the work of the Standardization Division during the past year.

The forenoon session for to-day is to be a joint conference of the Metal Mining Branch and the Coal Mining Branch of the Standardization Division. At this session the Chairmen of your General Committees will outline to the Conference briefly our plans for the work of the various sessions and also to review briefly the work accomplished by the two Branches during the past year.

We are greatly disappointed that Mr. Chas. A. Mitke, Chairman of the General Committee of the Metal Mining Branch and who has been on an extended trip to South America, has not yet returned. Mr. Mitke not only organized the work for the Metal Mining Branch but has directed this work through his various Committees during the past year. Mr. Mitke is an authority on Standardization and was not only interested in the subject but was writing extensively and trying to promote it long before many of us had learned to appreciate the importance of Standardization to the industries of our country. However, he has appointed Mr. McGrath, one of his colleagues, who will report to you briefly on the work of the Metal Mining Branch during the past year and who will have charge of the sessions of this Branch and present to the Conference any reports which this Branch may have completed ready for our approval.

Separate sessions will be held of the Metal Mining and Coal Mining Branches. Our object in arranging for separate sessions was to enable each Branch, before presenting any reports to the General Conference, to review such reports carefully and as far as possible harmonize these reports and thus save time for the General Conference.

SPECIAL JOINT COMMITTEE

We recommend to the Conference the appointment of a Special Committee of, say, two members from each Branch of the Division to re-

view reports presented by the Committees of the two Branches and take under consideration the following suggestions.

By reviewing these reports critically, this Special Committee will likely discover that certain conclusions have been reached and recommendations made by certain committees in the two Branches handling corresponding classifications of work which it will be necessary to harmonize and on which this Special Committee should report back to the Conference making recommendations.

METHOD OF PROCEDURE

Another question which it might be well for this Special Committee to take under consideration relates to the "Method of Procedure." After this Conference have completed their work on any particular classification or schedule and have in turn received from The American Mining Congress its approval of such standards—how shall we then proceed to place these standards below the Mining Industry and secure the adoption of these standards.

A method of procedure was suggested by Mr. Callbreath, Secretary of The American Mining Congress, in his "Introduction" in our first "Standardization Bulletin." This method of procedure suggested by Mr. Callbreath met with the approval of some of the Committees of the Coal Mining Branch and immediately on the issuing of this "Bulletin" the Chairman of such Committees proceeded along the lines suggested by Mr. Callbreath. Other Committees, however, have not followed this method and I think it would be well for us to decide this question finally at this Conference so as to have a uniform method of procedure.

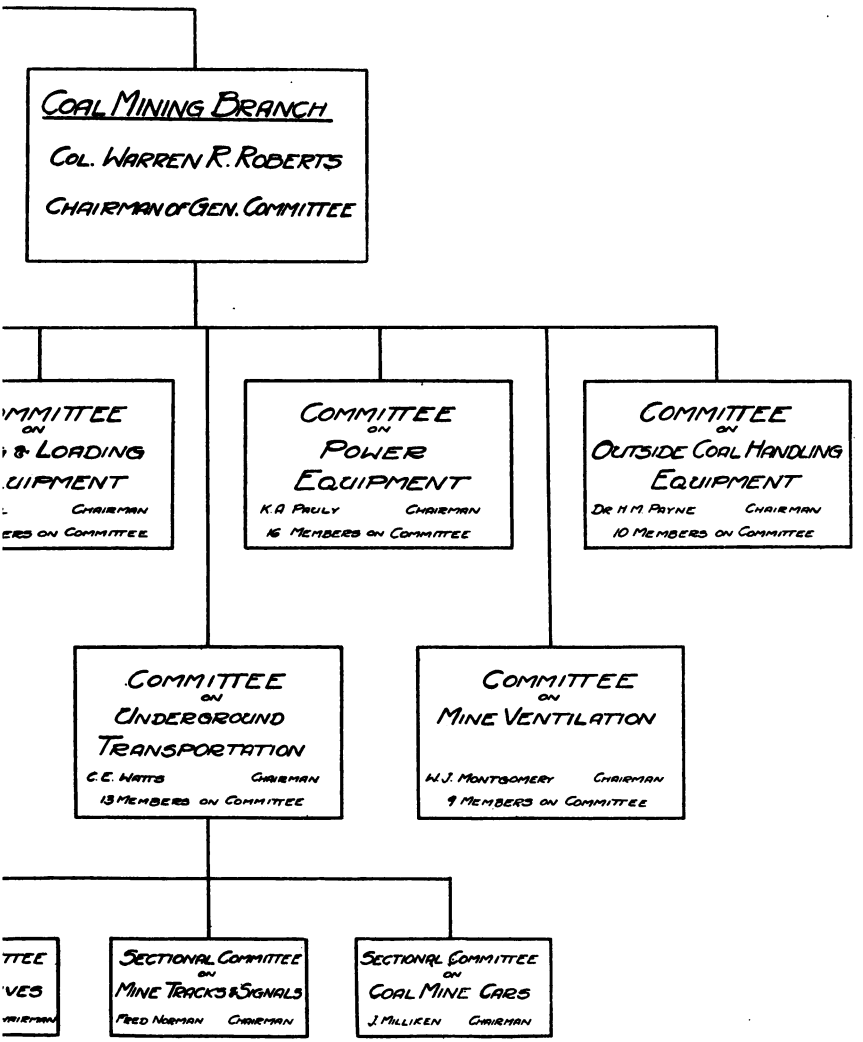
OUTLINE OF WORK FOR SPECIAL JOINT COMMITTEE

This Special Committee should also consider carefully suggestions which have been made in the past by the members of certain committees of each Branch that the work of such Committees in the two Branches might be handled more advantageously by combining these Committees which are now working separately for the two Branches. We had considered these suggestions when made and had not acted on the suggestions for the reason that at that time the work of the Committees, especially in the Metal Mining Branch, was not sufficiently developed to enable us to decide whether the practices in the Metal Mining on such classification of work was sufficiently identical with the practices in Coal Mining to enable such Committees to combine their work to advantage. We hope that the work of the various Committees is now sufficiently developed that it would enable a Special Committee to decide this question and make recommendation to the Conference. It is a very important matter and should have our most careful consideration. We believe this is a proper time for sufficient discussion of this question to enable us to decide the advisability of appointing such a Special Committee and will delay the further presentation of our report to allow for such discussion.

ORGANIZATION CHART

As preparatory to that discussion, I have prepared an organization chart of the Standardization Division of The American Mining Congress, so as to visualize the organizations doing the work for you. First we have the Metal Mining Branch, Mr. Mitke, Chairman. Then we have the Coal Mining Branch, of which I am the Chairman. Then we have an Advisory Committee on Safety Codes that is connected, of course, with both Branches.

Now let's consider the organization of these two Branches, which, up to date, have been carried on separately, each and every committee of each Branch carrying on their own individual work; and then we will consider the combining of certain committees.


COAL MINING BRANCH
COL. WARREN R. ROBERTS
CHAIRMAN OF GEN. COMMITTEE
MMITTEE
ON
& LOADING
UIPMENT
CHAIRMAN
ERS ON COMMITTEE
COMMITTEE
ON
POWER
EQUIPMENT
K.A. PAULY CHAIRMAN
16 MEMBERS ON COMMITTEE
COMMITTEE
ON
OUTSIDE COAL HANDLING
EQUIPMENT
DR H.M. PAYNE CHAIRMAN
10 MEMBERS ON COMMITTEE
COMMITTEE
ON
UNDERGROUND
TRANSPORTATION
C.E. WATTS CHAIRMAN
13 MEMBERS ON COMMITTEE
COMMITTEE
ON
MINE VENTILATION
W.J. MONTGOMERY CHAIRMAN
9 MEMBERS ON COMMITTEE
TTEE
VES
AIRMAN
SECTIONAL COMMITTEE
ON
MINE TRACKS & SIGNALS
REED NORMAN CHAIRMAN
SECTIONAL COMMITTEE
ON
COAL MINE CARS
J. MILLIKEN CHAIRMAN

There are certain committees in the Metal Mining Branch of which we have no corresponding committees as yet. For instance, they have one on Fire Fighting Equipment. We have formed no such Committee. They have a Committee on Mine Timbers; we have no corresponding Committee. We have no Committee on Drilling Machines and Drill Steel; and no corresponding Committee for their Committee on Steam Shovel Equipment. But these Committees which we have with the same titles appear identical and may be combined. That is for us to consider. There are three Committees that are common to both branches —Underground Transportation, Mine Ventilation, and Mechanical Loading Underground (we call our Committee, the Committee on Mining and Loading Equipment). It has been suggested, especially as regards the Committees on Mine Ventilation, that they be combined. Some men have said, "Well, mine ventilation is mine ventilation. There is no reason why any good specifications that are gotten out for the ventilation of a metal mine wouldn't apply to the ventilation of a coal mine." That broad statement is not correct. There are a great many differences in the ventilation of a coal mine and the ventilation of a metal mine; but there are many things that are common to both and specifications that would apply equally well in laying out a good ventilating system for both.

I think the gentlemen who make these suggestions usually have in mind that standardization applies to equipment only. There is a very great confusion as to what standardization really signifies and what we are trying to accomplish when we say we are standardizing for the mining industry. If we were trying to standardize mine fans, then there isn't any question whatever that the combination of those two committees would be advisable, but that is not what we are trying to accomplish; we are trying to improve the practice and the methods of mine ventilation, so that if a man has any good fan he can get efficient and economical results out of that fan, or if he has a poor old fan, he will get the best results that that fan could furnish. If he has a mine that is improperly laid out, no fan can ventilate that mine economically and he is wasting power beyond comprehension due to bad methods of laying out his mine.

This is so universally true that one of the things that we can do for the mining industry is to improve their methods and practices in mine ventilation. It is not only of very great importance from the humanitarian standpoint but it is just as important from an economic standpoint. I have visited mines where they had a great, fine, modern fan that they were not getting twenty-five per cent. efficiency out of. They were spending four times on current what it should cost to produce the amount of air that they were giving the mine.

That is what we are trying to do. Whether the laying out of a metal mine for proper efficiency and economical ventilation is sufficiently identical with the best practices for a coal mine is for us to decide. My idea was that some special committee that we would form for other purposes as well could take that question under careful consideration, after they had read the report that was given by the two committees, see whether they are attacking the problems along the same line or not and the committee could then draw up some conclusion.

I have not read the report of the Committee on Mine Ventilation for the Metal Mining Branch, but I have read that for the Coal Mining Branch. This Special Committee could easily decide and make recommendations to this Congress at a later session whether we should combine those Committees.

That same argument will apply just the same to Mine Drainage. Everything that I have said regarding mine ventilation applies equally well to Mine Drainage. Mine Drainage is something that is very little thought of by the average operator, especially in the coal mining industry. Doubtless more thought has to be given to it in metal mining.

Underground Transportation is another identical Committee so far as the title is concerned. This Special Committee should take those two reports and see if they are sufficiently identical that the work of those Committees can be combined.

Now in case the report is adverse and they don't recommend it, we will reap very great benefit by having had a careful, critical study made of these two reports and learn (if we don't combine them) whether there are any conflictions in recommendations that should be common—there is no question that there are many of the recommendations made by those corresponding Committees that should be common recommendations that will apply to both Branches of the industry and a critical study of these reports will, therefore, harmonize the reports at least in the portions where they should be harmonized.

That gives you as plainly as I can my ideas regarding the recommendations that have been made for the combination of these Committees that seem to be identical. We could act on that now, or possibly better we could appoint a committee and finally act on it after we get their recommendation. I think that would be advisable but my idea in outlining the whole subject now was for you to decide whether it was sufficiently important to appoint such a committee. I would like to hear from some of the members of the Metal Mining Division and some from the Coal Mining Division as to the advisability of appointing such a committee and having these reports immediately turned over to them so that they can start the work of making this critical examination of these reports.

Will some member of the Metal Mining Branch kindly speak for that Branch?

MR. T. O. McGRATH: I hardly think that the Metal Mining Branch is far enough along to do what you wish to do. There is only one completed report, that is on Underground Transportation. Mr. Mitke was unable to be present because the sailing of the boat delayed him, and the Metal Mining Industry at the present time is very much depressed and has been all the year. Practically all the copper mines are shut down and have been since April. A number of the Committeemen who were in these organizations have either been relieved on indefinite leave or they have been curtailed and combined with others and they have not had the time to finish their work, and out of the eight committees, as I say only one (that is Underground Transportation) is really in shape to be considered by a Joint Committee.

So I would say at this time, should you appoint such a Committee, they would not have the data from the Metal Branch to properly pass upon it. Mr. Daly, the Chairman of the Underground Transportation Committee is here, and for Mr. Mitke I intend to appoint Mr. Daly to take charge of these reports. There is one finished report and seven progress reports. The finished report is very well arranged, very well compiled and very well summarized and should be very interesting to all those interested in Standardization. Mr. Daly will preside at the sessions of the Metal Mining Branch. We will have five very valuable presentations, and Mr. Arthur Notman will preside at the General Joint Conference for Mr. Mitke, and Mr. Daly will take charge of the reports. His report being the only finished one. (The others are progress reports.) Mr. Daly is well qualified to take charge of this work. He is a man of vast experience in the mining industry, especially in the Metal Branch, and I feel that you will all be satisfied with his efforts. Just what the Metal Branch will do with these reports, will be thrashed out this afternoon at their meeting.

The progress reports are very interesting and I believe that every one here will be interested in hearing those progress reports. They are more or less general, to bring out the meat of what we are trying to do and probably might be more interesting than the finished reports.

I trust that every one interested in Standardization will attend the Metal Branch meeting, even though they only have one completed report.

CHAIRMAN ROBERTS: Mr. Daly, you will kindly advise the gentlemen what you think of appointing this Special Committee to consider the three important questions that I have outlined for such Committee to take under consideration?

MR. WM. B. DALY: I have only had about a half hour to go over the progress reports of the different committees in the Metal Branch, and that was this morning. As Mr. McGrath has informed you, there is only one finished report. The others are progress reports and some of them are in such shape that I do not believe very much good could come from a Joint Conference by the Committee which you have suggested—that is in the way of any completed work. As far as discussion, I think it would be interesting. I would be in favor of the appointment of a committee from the two Branches to go into the matter as far as could be gone into with the reports that are available.

Anything that I could do in the matter to assist in framing the thing out, I will gladly do.

MR. McGRATH: Another point that I failed to mention, I had a letter from Mr. Mitke recently. He stated as a very small percentage of the metal men would be present, and the fact that the reports are also in progress and unfinished, that he thought it would be better to only deal with those reports that were finished, and to invite all those who were interested from a manufacturing standpoint or other view-points and to get all the data that was possible to accumulate to help these Committees go ahead and finish their work.

MR. DALY: I believe myself, too, Mr. Chairman, that that would be advisable.

The work as presented by the Committees as I have gone over the matter this morning, is not such that a completed report could be made by Mr. Mitke if he were here. I think these Committees will continue their work even after the adjournment of this Conference. I believe also, as Mr. McGrath has stated, it would be advisable for the Metal Mining Branch to frame a general report of the work so far as it has progressed, to Mr. Mitke for his final adoption and approval, and then submit it to the Standardization Conference of the two Branches at a later time for printing if they so desire.

CHAIRMAN ROBERTS: Dr. Payne, Chairman of our Committee on Outside Coal Handling Equipment, will you kindly advise the Conference what you think about the appointment of such a Committee?

DR. H. M. PAYNE: I think the idea is a very good one but I don't see how such a Committee could accomplish anything very definite with nothing but progress reports. Such a Committee should be appointed and should take this action, probably subsequent to these meetings, when the final reports are done—in other words, let's create the organization but we can't get final results out of that Committee at the present time. I believe the idea is a good one but I don't believe they can possibly get finished results.

My idea would be, Mr. Chairman, that such a Committee might very properly make a report perhaps two or three months from now or six months from now so that at the next annual session we would then be able to make the consolidation you have suggested.

CHAIRMAN ROBERTS: I might add in explanation, that these suggestions came from the working Committees previous to the rendering of any reports, on the supposition that those three Committees that I mentioned (Underground Transportation, Mine Drainage, Mine Ventilation) had work so similar that they recommended a combination of those Committees; and I would be adverse to putting off a decision until the next Standardization Conference a year from now, for the reason, already raised by these gentlemen, that we would be duplicating effort. I

believe that a Committee could call in the representatives from the Committees on the two Branches and hear the evidence and likely decide this matter intelligently without waiting a year. However, that is for the Conference to decide.

I have had this matter brought to my attention two or three times and I have opposed it for the reasons I stated to you, that the work was not sufficiently developed at that time that anyone could intelligently decide whether it would be an advantage or a disadvantage, but I believe the work is sufficiently developed now even from the Committees that are only going to render progress reports, that by studying those progress reports you can learn whether the work is sufficiently identical to warrant the joining of the two Committees in a joint effort instead of working separately as now.

DR. PAYNE: If that is your thought, I move that a Special Correlating Committee be appointed at this meeting to take such action and report back to the Conference.

The motion was seconded.

CHAIRMAN ROBERTS: Gentlemen, you have heard the motion, and with Dr. Payne's permission and the permission of the seconder, I would like to add here, too, the name I suggested for the reason that it may be confusing—we have a General Correlating Committee working under the American Engineering Standards Committee that is a general Committee that we all report to, and I had suggested the name, "A Special Joint Committee representing the two Branches of the Standardization Division." I think it would be less confusing, and with your permission we will consider your motion in that way..

DR. PAYNE: That is satisfactory.

CHAIRMAN ROBERTS: Are there any further remarks or suggestions regarding this Committee before we put it to a vote?

MR. McGRATH: What will be the duties of that Committee?

CHAIRMAN ROBERTS: Unless there are further suggestions, their duties would be those outlined in my report.

MR. McGRATH: Will this Committee have the power to combine the work or will it simply make a report?

CHAIRMAN ROBERTS: Make a report to the Conference.

Before you vote on this question please recall the three important suggestions I made for this Committee to take under consideration: One very important matter for them to consider was the method of procedure, which I have already outlined. The Committee can take the "Bulletin and read Secretary Callbreath's suggestions in his introduction of the "Bulletin," which would be the detailed matter that they would take under consideration. You see we have three important matters for this Committee to take under advisement and report back to the Conference at a later session.

Are there any further remarks on this question before we put it to a vote? If not, all in favor of the appointment of such a Special Joint Committee will please say "Aye." Contrary "No."

The motion was unanimously carried.

I will now give you a brief review of the work accomplished during the past year by the Committees of the Coal Mining Branch which will be followed by a review of the work of the Metal Mining Branch to be presented by Mr. McGrath.

In our "Standardization Bulletin" beginning on Page 30 you will find the Reports, Briefs of Discussions, etc., of the Coal Mining Section (Branch) and beginning on Page 60 corresponding reports, etc., for the Metal Mining Section (Branch) with the exception that by some oversight one important report of the Coal Mining Branch; namely, the Joint Report of the two Committees on Underground Power Transmission and Power Equipment were not printed in the proper order and will be found on Page 71 of the "Bulletin." I am assuming that all our members and guests have read these Reports, Briefs of Discussions, etc.,

and are, therefore, familiar with the work of our Standardization Division as presented in the "Standardization Bulletin." I will, therefore, only review the progress which has been made on our work since our last Standardization Conference. This review must necessarily be made by reporting on the progress made by each Committee.

COMMITTEE ON MINE DRAINAGE

As indicated by the report of this Committee last year they had made no particular progress and the Committee was therefore immediately reorganized after our last Standardization Conference. The results by the reorganized Committee have been most gratifying. Mr. E. D. Knight, of the Cabin Creek Consolidated Coal Company, Kayford, West Virginia, was induced to accept the chairmanship of this Committee and by diligent effort he and his Committee have presented a very satisfactory progress report.

COMMITTEE ON OUTSIDE COAL HANDLING EQUIPMENT.

A change in the chairmanship of this Committee was made immediately after the last Standardization Conference as the Chairman of your General Committee had previously acted as Chairman of this Sub-Committee and found it impossible to continue to direct this work. The American Mining Congress persuaded Dr. Henry M. Payne, Consulting Mining Engineer of New York City, to accept the chairmanship of this Committee. Dr. Payne somewhat enlarged his Committee, immediately laid out a good program for them to develop and has an interesting report for your consideration.

COMMITTEE ON MINING AND LOADING EQUIPMENT.

A change was also made in the chairmanship of this Committee as Mr. Carl Scholz who had previously directed this work, having assumed new and larger responsibilities, could not continue to handle this work and with his assistance we secured Mr. C. A. Cabell, Vice-President, Carbon Fuel Company, Charleston, West Virginia to act as Chairman. We regret to report, however, that Mr. Cabell has been facing so many difficulties, along with other operators of West Virginia, that he has not had the time to devote to this work which its importance justifies. This Committee, therefore, will not present a report but will offer a program for discussion at our Conference and we hope that by this method we will develop this subject and be able to have some sort of a report drawn up for this Committee to be contained in our next "Standardization Bulletin."

I have a suggestion to make regarding that report and corresponding reports from the Metal Mining Branch. That is, that the gentlemen in session at the Coal Mining Branch will take reports of that character under consideration and will endeavor, out of the material furnished by the Committee, to prepare at least a progress report that will be suitable to go into our "Standardization Bulletin" which we are going to issue early next year, so that we can put before the industry what we propose to do on that classification work, even though we have not a completed report.

Then the industry will have something to consider when they receive our "Bulletin."

COMMITTEE ON MINE VENTILATION.

This Committee presents a most satisfactory report, being an amplification and revision of the report they rendered at our last Conference in Denver. Many recommendations are offered by this Committee which will deserve the most careful consideration of our Conference.

COMMITTEE ON UNDERGROUND TRANSPORTATION.

I wish to call especial attention to the report of this Committee as the method of handling their work offers, to my mind, an excellent suggestion

for some of our other Committees. This Committee presented a very excellent report at our last Standardization Conference, which has acted as a basis for their work during the past year. On resuming their work this year they divided Underground Transportation into three classifications; namely, "Mine Tracks and Signals," "Mine Locomotives" and "Mine Cars" and appointed a Sectional Committee to develop a program and a report with recommendations to the main Committee. Their reports are therefore offered in this form; namely, One General or Reviewing Report and three Sectional reports on the subjects named. I suggest that some of our other Committees having classifications of work that could advantageously be sub-divided into sections, follow the procedure of this Committee for by so doing and carefully selecting the chairmen and members of such Sectional Committees the work can have more careful and detailed consideration.

JOINT COMMITTEE ON POWER EQUIPMENT AND UNDERGROUND POWER TRANSMISSION

When these two Committees started to develop their work last year they decided that the work was so intimately interwoven that they could conduct their investigations more advantageously by working together, they therefore followed this method and rendered a joint report. This report is the one referred to as being disconnected from the other reports and will be found on Page 71 of the "Standardization Bulletin." A review of this joint report indicates that a vast amount of careful and conscientious work was done by this joint Committee.

When we requested this joint Committee to prepare a program for this year's work they advised that they wished to delay further work on their subjects until they could receive the "Standardization Bulletin" and thereby furnish members of their Committees and also have for distribution to the Industry, copies of their last year's report together with discussions at the Conference, etc. Due to an unavoidable delay in the issuing of the "Standardization Bulletin" this joint Committee therefore did not undertake any work during this season and will have no report to offer at this time. They advised us, however, that they have followed the method of procedure suggested by Mr. Callbreath in his "Introduction" to the "Standardization Bulletin" and that on receiving replies from men in the Mining Industry and allied professions that they will then take under consideration the suggestions made in these replies and make such revision of their joint report as seems advisable.

That completes my report for the Coal Mining Branch.

If Mr. McGrath has any further presentation, we will now hear from him.

MR. T. O. McGRATH: There is hardly anything further to present on behalf of the Metal Branch other than what I have already said—that is that the Underground Transportation Committee has prepared an excellent report, very well compiled and arranged, and they intend to make detailed recommendations on the different points brought out at this meeting.

The Mine Timbers Committee has made an excellent progress report. In that connection I might mention that the U. S. Bureau of Mines have arranged for a display on Wood Preservation to be exhibited at Booth 171. This is an impartial display, under the jurisdiction of the United States Bureau of Mines. It does not represent any particular mine, and I am informed it is something of great interest to everyone interested in mining, especially mine timbering and preservation of timbers.

Mr. Daly will give you more information later. The Metal Branch is really here to do work more than to report. They want all those who are interested not only on the Committees but otherwise to attend the meetings and give all the assistance possible, but later they will have to send in their completed report.

CHAIRMAN ROBERTS: Before we adjourn, there are just one or two things that I want to speak about. First we should appoint this Special Joint Committee, and I would like suggestions from Mr. McGrath, after consulting with the gentlemen present representing the Metal Branch, as to the two members on this Committee that they will appoint.

I think that a Committee of Four would be sufficient. We want to take as few out of our working organization as we can, to take this matter under discussion, and if these gentlemen will give me the names after we adjourn of their two representatives, I will confer with the men immediately upon adjournment. If they will remain here for a few moments we will select the representatives so that we can turn this matter over to this special committee and they can take it under consideration.

You see one of the important objects of appointing this committee was not only to consider these two or three questions to report on later but I thought of taking the Committee on Underground Transportation—the two branches have finished reports and have good reports—I think this Special Committee could to advantage take those two reports and study them carefully and see whether there is any lack of harmony in those reports that could be harmonized. There may be things recommended, for instance, by the Committee on Underground Transportation in the Metal Mining Branch that will conflict with recommendations made by the other Committee in the Coal Mining Branch that could be harmonized and made practically identical in certain features of those reports and recommendations. There may not be, but very likely will be, and I think that is one of the very important things that this Committee could do for us.

MR. DALY: We would like to have a meeting or two of that division before that Committee would meet as a Joint Committee with the Coal Mining Committee.

CHAIRMAN ROBERTS: I have another suggestion to make to the Conference. Do we want a Resolutions Committee? The American Mining Congress will appoint, at least, if they follow the practice in the past, a Resolutions Committee which will be the busiest Committee in session at The American Mining Congress. This being a very large division, by far the largest division of The American Mining Congress and having very important work under consideration, I thought it quite possible that we would want a Resolutions Committee of our own to consider any resolutions that may be presented by members of the Standardization Division and review them before we sent it to the Resolutions Committee. We may have some recommendations that we want to make or resolutions that we want to present to the Resolutions Committee of the General Convention. If we do that we should have a committee to carefully consider any resolutions that may be suggested or handed in to our Conference before they are sent to the general Resolutions Committee.

Do you think it best for us to have such a Committee?

MR. JAS. MILLIKEN: I think it is very important that the Standardization Branch, particularly the Coal Mining Division, have such a Committee, and I make a motion that you appoint a Committee of that kind.

The motion was seconded by Dr. H. M. Payne.

CHAIRMAN ROBERTS: It has been moved and seconded that the Conference appoint, through their Chairman, a Resolutions Committee. Are there any further remarks or suggestions on this question? If not we will put the question.

The motion was carried.

CHAIRMAN ROBERTS: I will, after consulting with the members of the two Branches, appoint a Resolutions Committee.

If any of you have anything on your minds that you want to present to the Resolutions Committee of The American Mining Congress for their consideration, please hand it in, in written form to this Resolutions Committee for their consideration.

At our St. Louis Convention two years ago we presented two of the most important resolutions that were offered in the convention from our Standardization Division and they were both adopted by the Resolutions Committee and by the Convention. I was on the Resolutions Committee that year myself, and there was more earnest discussion brought about by those two resolutions handed in by the Standardization Conference than any other resolutions that were presented to the Resolutions Committee, that is, the general Resolutions Committee of the convention.

We would be very glad to have any gentlemen who have any suggestions to make to the convention to pass them in to our Resolutions Committee.

If there is nothing more, we will adjourn.

The meeting adjourned at 12:00 m.

ADJOURNMENT.

COAL MINING BRANCH

October 17, 1921—2:30 P. M.

The first meeting of the Coal Mining Branch of the Standardization Division of the American Mining Congress, Monday afternoon, October 17, 1921, convened at two-thirty o'clock, Colonel Warren R. Roberts presiding.

CHAIRMAN ROBERTS: This is the First Session of the Coal Mining Branch called for on our program at two-thirty P. M. Before I start in on our program, I will announce the Special Joint Committee that was authorized this morning, as recommended by your Chairman. Representing the Metal Mining Branch we have Mr. William B. Daly and Mr. Arthur Notman and representing the Coal Mining Branch we have Colonel J. Milliken and Mr. E. D. Knight. That is the Special Joint Committee, to whom we will refer our reports for consideration as recommended by your Chairman.

You will notice according to our program that this afternoon's session is to be devoted to the receiving and consideration of reports from our Committees and the first report that we are going to call for is the one on "Mine Drainage" by Mr. E. D. Knight of Kayford, West Virginia.

REPORT OF THE COMMITTEE ON MINE DRAINAGE

It is the opinion of your committee that the subject of MINE DRAINAGE should be taken up under two heads, namely: (1) Mine Drainage by Pumping or Mechanical Means; (2) Mine Drainage by Other Methods.

1. MINE DRAINAGE BY PUMPING OR MECHANICAL MEANS

Were it possible to standardize the design of mine pumps, this committee could only recommend such procedure in the event that we believed that the ultimate achievement in such design had been reached and that no benefit could accrue either to user or maker from the competitive manufacture of such equipment. This is patently not the case and we have consequently attempted to perform our work along lines, which we consider more useful to all concerned.

It is our belief that there are a number of different sorts of problems which confront us in Mine Drainage, and though these differ widely due to local conditions, we think that they may be roughly separated into several general classes from the standpoint of service required from pumping equipment.

We have attempted therefore, to divide drainage problems into these several classes, and to set down certain specifications for pumps suitable for service within each class, which in no way limit the design of such equipment but rather set for each a criterion of performance within its group.

We have further appended a list of what we believe to be good

and safe rules for the installation, and operation of mine pumps, and we recommend same as standard practices.

A short discussion of other means of mechanical drainage is also included.

A. CLASSIFICATION OF MINE DRAINAGE PROBLEMS WITH RECOMMENDATIONS AS TO PUMPING EQUIPMENT.

I. DRAINAGE OF WORKING PLACES.

(a) This classification, usually termed "Gathering Work," is generally applicable to rooms or entries driving toward the dip, where there is a constant flow of water sufficient to impede the proper removal of coal. Pumps are necessary when the volume of water makes bailing uneconomical. Discharge lines are usually carried to sump for removal by larger pump, to drainage ditches, or to abandoned workings.

(b) We recommend the following specifications for gathering pumps.

1. CAPACITY.

Sufficient to keep down the flow of water by continuous pumping throughout the working day, and to handle water accumulating through the night in the most economical manner to have place dry for resumption of work. Too large an equipment increases inefficiency of unit as steady flow necessitates continuous pumping and number of gallons per minute pumped cannot exceed that of flow regardless of size of equipment. A capacity of twenty to sixty gallons per minute is usually applicable to most gathering installations.

2. HEAD.

A head in excess of 125 feet usually presupposes a permanent installation for taking water outside the mine. We recommend this as a maximum head for gathering pumps, and further recommend a limitation of motor horsepowers to protect such pumps from improper installation.

3. PORTABILITY.

Gathering pumps are usually moved for two reasons, namely: Development of place beyond the suction limits of the pump; elimination of condition which brought about installation, either through the working out of the place or rise in the floor of the mine causing a natural drainage away from the working face. We recommend that pumps moved less than twice yearly under normal operating conditions be not classified as gathering pumps. We further recommend that gathering pumps be as light and compact as possible and that the weight of the assembled unit be the minimum in keeping with sturdy construction.

4. PERFORMANCE.

We recommend the selection of a pump for gathering work which will start without priming, pump air and water alternately, keep a flow of water with the suction only partway submerged, pass small chunks of coal and other extraneous matter through its valves, have valves readily accessible for cleaning, and function properly with a minimum of attention. This would seem to limit selection to positive acting pumps and for simplicity of design and fewness of working parts, we recommend a single cylinder double acting piston pump for this purpose.

II. DRAINAGE OF ISOLATED BODIES OF WATER.

(a) This condition is usually brought about by swags or low spots which collect sufficient water to interfere with haulageways or which if not kept dry will allow the water to overflow to places here it will otherwise hamper the operation of the mine. Such conditions necessitate the installation of a permanent pump.

(b) We recommend the following specifiiations for pumps to meet this condition.

1. CAPACITY.

Where volume of water is such that it need be pumped out only once daily, a pump of sufficient capacity should be installed to drain said place during part of the working day, so that in case of necessity repairs may be made without impeding the operation of that section of the mine. Where the volume of water is sufficient to preclude such practice, the installation of a sump is recommended. Same to be of sufficient capacity of prevent damage to that portion of the mine due to a few hours interruption of pumping.

2. PERFORMANCE.

Where power interruptions are likely to be frequent and it is desirable to mimimize attendance, a positive acting pump which does not require priming is recommended.

III. UNWATERING OF ABANDONED WORKINGS.

(a) Often it is desirable to reopen abandoned workings which have been allowed to fill with water due to lack of pumping for several years where there is only a moderate flow under normal conditions, seasonal influx of surface water, or the diverting of drainage from other portions of the mine into same. This condition usually implies the installation temporarily of a larger pump for the unwatering than is necessary for proper drainage under normal conditions.

(b) We recommend the following specifications for pumps to meet this condition.

1. CAPACITY.

Sufficiently to economically remove the water within a reasonable length of time. This means a capacity ample to take care of the natural flow of water, if there be such, and at the same time remove the desired amount of accumulated water.

2. PERFORMANCE.

Where head conditions are adapted to same a centrifugal pump is recommended due to its lightness, compactness, and to ease with which it may be installed in crowded places difficult of access. Precaution should be taken, however, to be sure that during the process of unwatering, the pump will not have to be moved sufficiently to vary the head beyond the limit of flexibility of this type of pump. If such is likely to be the case a positive acting pump should be used. Water which has been standing some time in a mine is likely to become high in content of sulphur or other injurious chemicals. It is good practice to have such water analyzed before purchase of a pump and if such be the case use a bronze fitted pump or one with a complete bronze water end.

IV. DRAINAGE OF SUMPS, WHERE WATER COLLECTED FROM OTHER PARTS OF THE MINE IS DISCHARGED, OR OTHER LARGE BODIES OF WATER.

(a) This condition usually implies a body of water sufficient in quantity to interfere with the entire operation of the mine if same is not kept properly drained.

(b) We recommend the following specifications for pumps to meet this condition.

1. CAPACITY.

Sufficient to handle the situation under maximum water conditions and consisting of one or more units.

2. RESERVE CAPACITY.

One or more units for standby in case of breakdown capable of duplicating in performance the regular pumping equipment.

3. PERFORMANCE.

Where head conditions are adapted to same, centrifugal pumps are recommended due to their economy of space and simplicity of working parts. Where electric power source is unreliable and when pumps are located within the limits of economical steam transmission the use of steam pumps is considered good practice. It must be remembered, however, that use of steam pumps, unless compounded is very wasteful. Where both steam and electricity are obtainable, if danger from interruption is sufficiently grave, units may be so selected as to make either source of power available for pumping.

B. GENERAL RECOMMENDATIONS FOR THE MANUFACTURE AND SELECTION OF MINE PUMPS.

We recommend the following:

1. That wherever possible United States Standard Thread be used on all bolts, nuts, and plugs.

2. That as few different sizes of bolts, capscrews, studs etc., be used in the construction of a mine pump as are compatible with good design.

3. As complete a standardization of pumping equipment by individual users as conditions will permit and when a purchaser is on the market for additional equipment, the keeping in mind of the fact that, all other things being equal, a saving in initial cost, unless very considerable in amount, rarely compensates for having to keep two different sets of repair parts in stock.

C. STANDARD PRACTICES FOR THE INSTALLATION AND OPERATION OF MINE PUMPS.

I. PIPE LINES.

We make the following recommendations in regard to mine pipe lines.

(a) Pipe lines should always be large enough so that the friction head combined with elevation against which the pump is working is well under the total head against which the pump is designated to operate. Lines of sufficient size to restrain velocity of water from rising above six feet per second are preferable. The following friction tables should be used for determining the sizes of all pipe lines.

Friction Loss of Head in Feet Per Thousand Feet Pipe.

G. P. M.	1.5″	2″	2.5″	3″	4″	6″	8″
30	110	38.4	12.9	5.4	1.32	.20	
40	188	66	22	9.1	2.23	.30	
50	284	99	33.2	13.8	3.39	.46	
60		139	46.5	19.2	4.72	.67	
70		184	62	25.7	6.3	.86	
80		237	79	32.8	8.1	1.12	
90		294	98	40.8	10	1.42	
100		358	120	49.6	12.2	1.73	.45
140			223	92	22.8	3.12	.78
200			431	178	44	5.9	1.50
240				251	62	8.3	2.12
300				380	93	13.0	3.2
400					160	22.0	5.45
500						33.6	8.2
600						46.0	11.5
800							19.0
1000							30.0

Note: This table is taken from "Hydraulic Tables" by Gardner S. Williams and Allen Hazen.

The friction in a 90 degree elbow should be regarded as equivalent to one hundred feet of straight pipe. As a general rule we recommend increasing and never decreasing, the size of pipe over the pump connections.

(b) The use of boreholes to the surface for the discharge of all permanent pumping stations is recommended unless some specific local condition makes same inpractical.

(c) The use of wooden discharge lines or lines of other acid resisting materials, together with cast iron suction lines is recommended where chemical content of the water makes wrought iron lines short lived.

(d) Where pipe lines parallel haulageways in which the rail is used as a return circuit, the line should be bonded to the rail as specified by committee on Underground Power Transmission to prevent electrolysis.

(e) The installation of valves at convenient points in discharge lines to draw off water for sprinkling dust is considered good practice.

II. PERMANENT UNDERGROUND PUMP STATIONS.

(a) All Permanent Underground Pump Stations should be installed as specified in rules for underground stations in report of Sub-Committee on Underground Power Equipment.

(b) All steam driven pumps should have well insulated lines, expansion joints, and the lines should show no signs of escaping steam.

III. TEMPORARY OR PORTABLE PUMP INSTALLATIONS.

(a) All temporary or portable pump installations should be wired as specified by Committee on Underground Power Equipment.

(b) Wherever possible pumps should be so placed in relation to the body of water to be pumped that a shut down for a reasonable period of time will not place the apparatus in danger of being drowned out nor handicap the workmen in repair of same.

IV. STARTING EQUIPMENT FOR ELECTRICALLY DRIVEN PUMPS.

(a) The use of Hand Starting Rheostats on direct current pump motors is condemned as an unsafe practice. The likelihood of uneven acceleration, the not uncommon failure of handle to fly back to off position on interruption of power supply, and where interruptions are frequent and attendance lax the danger of having the handle tied back, make this method of starting motors both dangerous and unreliable.

(b) The use of Automatic Starters is recommended for all direct current pump motors and great care should be taken in the application of same. A careful study of load and voltage conditions should be made in each case and the fact always kept in mind, that where one type of starter will work admirably under one set of conditions even when installed on an identical equipment under different conditions it may be a total failure.

(c) Due to the freedom of most alternating current circuits from interruptions and the high initial cost of alternating current automatic starters, we recommend enclosed starting switches with no voltage release and overload protection on motors up to and including seven and one-half horse power, unless load conditions do not permit their being thrown across the line. For larger motors automatic starters are recommended unless local conditions do not justify their expense, in which case we recommend hand compensators.

(d) Where the pump operated requires the presence of an attendent after each interruption to see that same is properly primed or for any other reason, we recommend starters which have no voltage release but which accelerate automatically on the closing of a hand operated pilot switch.

V. GUARDING OF EXPOSED PARTS.

We recommend conformation to State Compensation laws as regards the protection of all gears, pulleys, and projections on revolving shafts. Where state laws are lax, we recommend compliance with Rules 1, 2, 5, 6, and 12 under Item 26, General Bituminous Coal Mine Safety Standards 1921.

VI. LUBRICATION.

We recommend frequent and careful inspection in regard to lubricating system of all mine pumps and motors and the equipping of all mine pumpers with proper oil and grease containers which will exclude extraneous matter from their content.

VII. INSULATION.

Where pump motors are to be installed in particularly damp places, we recommend the specification of especially impregnated windings in the purchase of such motors.

VIII. CARE OF PUMP MOTORS WHEN NOT IN USE.

Where pumps are shut down over periods covering several weeks, we recommend the removal of the motor to a dry place, or in direct current motors, the removal of field coils and armatures, or where this is impossible the running of such motors for an hour or more daily in order to prevent damage to the windings through mildew and dampness.

IX. SEMI-REMOTE CONTROL FOR PROTECTION OF OPERATORS.

We recommend the placing of a switch in the main feed line or a switch which will open the circuit of the starting device in such place in relation to the installation that the operator may open the circuit in cases of emergency without subjecting himself to danger from flying pieces in case of breaking a connecting rod, gear, or similar part.

X. DISCHARGE VALVES.

To reduce the possibility of the breakage of parts in reciprocating pump always be sure that all valves in the discharge lines are open before starting pumps.

XI. PRIMING OF PUMPS.

Few pumps if any can be depended upon to pick up their water and prime themselves when absolutely dry and where there is very much suction lift and especially where pump is to deliver water into a line already under pressure. It is therefore absolutely necessary in some cases and always desirable to see that pumps are carefully primed before starting.

We therefore offer the following suggestions for the proper priming of pumps.

(a) Piston and Plunger Pumps.

If pump to be started is New or has not been operated for some time all suction and discharge valves should be lifted from their seats to make sure that each will operate freely—then with the discharge valve cover plates removed, lift one discharge valve in each chamber and fill the cylinder and valve ports in that chamber entirely full of water. Replace all cover plates and after seeing that there is a free outlet to the atmosphere, start pump and run until all air is pumped out and clear solid water is delivered. Pump is then ready to operate on regular conditions. It is seldom necessary to repeat this priming operation although it is always good practice to have discharge line connected up to include a Tee with valve or cock so that at any time the pump can be operated against atmospheric pressure only and so make sure all cylinders and valves are working properly.

(b) Since a Centrifugal Pump together with its entire suction line must be wholly free from air, priming is of great importance and some positive method should be adopted. We offer the following suggestions:

1. **Never try to prime a centrifugal pump while it is in motion.**
2. **Always Use a Good Strainer on the Suction Intake.**
3. **Priming by Use of Foot Valve.**

Where pump is in low lift service a plain combined Foot Valve and strainer may be used on the suction intake pipe and water poured into an opening provided for the purpose and at a point higher than the top of pump shell, a pet cock should be screwed into the highest point of the pump shell and kept open until all air is expelled. Pet cocks should also be screwed into any high spots in the suction line where air would be trapped. When water flows freely from highest pet cock, pump is then primed and should be started immediately. It should be

remembered always that a Centrifugal pump will seldom operate against a pressure when air gets into the pump either through the suction pipe or the stuffing box or any other place. When pump is to operate on a high head, a very dangerous pressure may be developed in the pump shell and suction pipe and fittings when pump is stopped by the resulting back surge of the water. Pumps under these conditions should therefore be protected by a swing check valve on the discharge and a By-Pass put in to run water from the discharge back through the pump into the suction, otherwise proceed as under low head conditions.

4. Priming Without Use of a Foot Valve.

It is often very desirable to eliminate entirely the use of a foot valve, in which case the pump would be primed by exhausting all air from the pump and suction line, using a check valve or gate valve or both in the discharge line near pump to prevent any air from coming in through the discharge connection. In order to get an air tight shut off it might be necessary if pump has been out of use for awhile to run some water in the discharge to seal the valve. To exhaust the air we suggest the following methods:

(a) When pump and connections are comparatively small connect the suction of a small pitcher spout pump or any good hand pump including the horizontal double acting type, to the highest point of pump shell. Prime the hand pump with a very small quantity of water and operate until all air is exhausted and clear water is delivered. Then close valve in suction connection to top of pump shell and start centrifugal immediately. Remember that a centrifugal pump can be started or operated a short time without injury against a closed line where in the case of a recriprocating pump something would be sure to break.

(b) By the use of a small double acting motor driven piston pump connected to top of pump shell the same as with hand pump.

(c) By the use of a steam ejector, if steam is available, connect suction of ejector to top of pump shell with valve or cock and operate until pump is primed and proceed as above.

(d) By the use of a hydraulic ejector used the same as steam ejector provided water under a pressure 20 pounds or more can be obtained. Sometimes there is sufficient water stored in the discharge line beyond the check valve to properly prime a pump by the hydraulic ejector, in which case a hand pump as under (a) should also be installed to have a positive method available.

(e) By use of Hydraulic Ejector operated by a small auxiliary direct connected motor driven pump taking water from the bottom of a barrel and discharging about 40 to 50 gallons per minute at 20 pounds pressure through the ejector back into the same barrel.

XII. ATTENDANCE.

(a) We recommend definite fixing of responsibility for the operation, care, and inspection of each piece of pumping machinery in such a manner that same will be insured of proper attendence at regular intervals, and will not be forced to rely on haphazard attention delegated to whoever happens to be in the vicinity at convenient times.

(b) We recommend more careful selection of pump attendants and believe that more stress should be laid upon a man's fitness for the job, and that the operating of mine pumps should be not regarded as a system of pensioning men unfit for more useful work as is often the case at present.

(c) We recommend equipping mine pumpers with proper tools for the work they are required to do and the adoption of systematic methods for making them responsible for these tools. This we believe will in many cases prevent damage from the use of makeshift tools or from bolts, nuts, valve covers, etc., which work loose, not being properly tightened.

(d) We recommend the general principle of making every installation as "foolproof" as possible and then getting the best man obtainable to look after it.

D. OTHER METHODS OF MECHANICAL DRAINAGE.

I. AIR LIFT PUMPING.

Air lift may be used to advantage when it is advisable to keep the pumping equipment on the surface.

II. WATER HOISTING.

We believe that the number of mines at which water hoisting can be economically carried on is too limited and the individual application of this method of drainage too varied to make any recommendations concerning same.

2. OTHER METHODS OF MINE DRAINAGE.

A. THE SIPHON.

I. We offer the following suggestions for the installation of mine siphons.

(a) That all joints be carefully made and all threads be examined before joining to insure as near an absolute exclusion of air as is humanly possible.

(b) The use of a larger size of pipe on the suction leg of a siphon than on the discharge leg, in order to lessen the resistance of the water in entering.

(c) The elimination of all sharp bends in a vertical plane, which would tend to form air pockets and the laying of the siphon as nearly as possible on a gradual uniform grade.

(d) Submergence of the discharge end of the siphon either in a sump, small tub or barrel, or by using an elbow and nipple on the end of the discharge the same making a right angle with the line on a vertical plane.

(e) In charging the siphon it is good practice to have the charging point at or near the high point of the discharge leg but this is not absolutely necessary as the siphon may be charged near the suction end. It will be found good practice to tap the discharge leg at its highest point and here connect a stand pipe to allow air to escape while siphon is being charged. When all air from the siphon has been expelled the water will flow smoothly from the stand pipe. When this point is reached close valve on stand pipe and gradually open valve on discharge end. Siphon may also be charged by use of common pitcher spout pump, the same placed either on the end of the discharge leg, or where temperature conditions do not permit or same interferes with submergence, at the same point as the standpipe referred to above.

II. THE SIPHON IS RECOMMENDED FOR THE FOLLOWING USES.

(a) Bringing water from one level to another inside a mine where ditching would be too expensive.

(b) Draining bodies of water which collect in low places near drift mouths, usually due to seasonal influx of surface water.

(c) Draining abandoned workings which have been allowed to fill up with surface water.

III. LIMITS OF THE SIPHON.

The theoretical limit to which water can be raised with a siphon is thirty-four feet at sea level. From fifteen to twenty feet seems to be the practical limit in mine use. We do not recommend the use of the siphon where it cannot be installed properly without the removal of so much rock or slate as to make its economy as compared to pumping doubtful.

B. DRAINAGE DITCHES.

I. We recommend closer cooperation between Engineering, Operating, and Power and Mechanical departments of all mining companies to the following end.

(a) That when a drainage problem first appears, the levels of the mine be gone over carefully to see if this water cannot be economically handled by ditching instead of a hurry call being sent in for a pump.

(b) That where several bodies of water are to be handled in the same mine, a careful survey be made to see if this water cannot be collected by ditching to a central point for disposal.

(c) To be sure that all mechanically handled water is being

disposed of in the proper places, and that no water is being unnecessarily pumped when it could be handled in a simpler manner.

II. We believe that there is too great a tendency on the part of operating men to handle drainage problems as they have been handled in the past and to fail to look forward to future benefits which may accrue from changed methods. We desire to call attention to the fact that a permanent system of drainage ditches often implies a considerable outlay of initial expense, which unfortunately in many cases seems to form a barrier beyond which the operator refuses to look, thereby losing sight of the fact that when such a system is properly installed, the expense generally stops there, while an elaborate pumping equipment usually means a continual expense for upkeep, operation, and depreciation during the life of the mine. Further than this it must be kept in mind that a properly installed system of ditch drainage is much more reliable in operation than drainage by any mechanical means. We therefore recommend the following procedure in considering the solution of new drainage problems or the improvement of existing ones which are proving both troublesome and expensive.

(a) Determine whether or not the construction of a drainage ditch is possible. By possible we do not mean whether on the face of it it appears practicable but whether from an engineering standpoint it can be done.

(b) Estimate the expense of constructing such a ditch taking into consideration cost of excavating, material for lining and the placing of same, and interest on investment.

(c) Divide this total by what may be reasonably estimated as the life of the mine or that portion thereof which requires drainage.

(d) Balance this against the annual investment for repairs, attendance, interest on investment, and depreciation of proposed or existing pumping installations.

(e) Remember that should these show an equal yearly average of expenditure or one slightly in favor of the pumping equipment, that the balance should still be in with the drainage ditch due to its greater reliability of operation and its freedom from the possibility of breakdowns which might hamper the production of the mine as well as bring about unforeseen damage. Also the removal of the responsibility and worry of operating pump equipments from the executive force of the mine should tend to increase their efficiency in other phases of coal production.

With a system of ditch, or tunnel, drainage a great advantage is obtained in case of shut downs from any cause whatever as your drainage will continue without the cost of power and practically without attendance.

E. DRAINAGE OF BOREHOLES.

It has in some few cases occurred that a seam of coal has been operated above a worked out seam, or one where there is good natural drainage, so that it was possible to put down a borehole connecting the two seams, and thereby drain the water in the upper seam into the workings of the lower. We recommend this simple and effective method of drainage to those so fortunate as to have conditions where it can be made operative.

Respectfully submitted,

E. D. Knight, Chairman.
M. C. Benedict,
Walter D. Stockley,
E. F. Austin,
Cecil W. Smith,
F. J. Emeny,
Professor John W. Hallock,
R. Y. Wert,
J. H. Edwards,
L. D. Tracy,
M. Spillman,
Henry E. Cole.

CHAIRMAN ROBERTS: Gentlemen, you have just heard the report and recommendations of your Committee on Mine Drainage. I notice by referring to the personnel of this committee that it is composed of four independent consulting engineers, three representatives of standard, well established mine pump manufacturers, and the others are all operating men for coal mines including the chairman of the committee, and other engineers that are in responsible positions of maintaining mines as far as their drainage is concerned, like Mr. Wert, the Mine Drainage Superintendent of the Soddy Coal and Iron Company.

I only mention this to indicate to you the care with which these committees have been selected. We have tried to have each and every committee cover the entire field by having those three branches of the industry represented, the same as this committee represents those three branches of the industry.

I think this report typifies what I have tried to impress upon all of the committees in approaching this question of standardization—that before attempting to standardize equipment they should carefully consider the larger problems connected with improving the practice and methods in connection with their work, and you will notice throughout that the great burden of the report is to try to accomplish those ends and thereby improve the conditions of mine drainage at our mines, where we all know there is a large field for improvement.

There is an immense amount of material in this report, and if we were to go into it in detail, it would take us a day to digest it, and that was one reason that I recommended that these reports, after consideration by the Conference, should be referred to a committee for more careful and detailed consideration. It is not possible for us to hold in our minds all of the splendid recommendations made by these committees, but it is quite possible that some of you may be impressed with certain recommendations that have been offered, to which you take exception, and if so now is the time to offer your suggestions to the Conference.

We would like to hear from any one who has followed this paper and has heard any recommendation made by this committee that does not appeal to him or that he thinks he can improve upon. That is the object of reading these before the meeting.

MR. KUDLICH: In relation to the installation of electric pumps, Mr. Knight quotes the National Electric standard, I think it is, and in the protection of the circuits, the starting devices, circuit breakers, etc. I think the Underground Power Transmission Committee in their report have covered that from the standpoint of the electrical engineer rather than the mechanical engineer, and I think I have drawn up pretty good rules on that. I would suggest that this report be amended to refer back to the other committees report rather than adopt new rules on those questions.

MR. KNIGHT: Mr. Chairman, the only time any mention was made of wiring was when I did refer to that report in one instance in the case of a permanent pumping station. The only other instance was in the portable, or temporary stations, and I said, I believe, in the report, "As nearly as possible, the wiring is to conform to underwriters' rules," and if I remember correctly, that was pretty much the same way that was brought out in the other report that Mr. Kudlich mentioned.

Of course if a pump is going to be moved about, it is not possible to absolutely conform to any set of wiring rules, but my idea in mentioning that was really to set some standard to aim at and if you got half way there, you would probably be better off than if you aimed a little lower and did not get quite to that.

The only other mention that was made of wiring was in the case of control, and of course that is merely a proposition of selection and not the method of installing.

CHAIRMAN ROBERTS: I think Mr. Kudlich's suggestion, notwithstanding the defense given by the chairman, is an excellent one and is exactly what your Chairman had in mind when he said that these reports must be correlated.

Are there any further remarks or criticisms to be offered on this report? Please do not hesitate to make any criticism or suggestion that occurs to you. We want the broadest possible discussion before we refer them to the Committee, and then the Committee will give them more detailed consideration.

MR. VAUGHAN: There is one thing that I would like Mr. Knight to explain, relative to the syphon. He goes on and recommends certain ways of putting it in, and so forth, but he does not say anything about how it should be charged nor where it should be charged. My experience with syphons is that in the winter time, if we put a pump on the lower end, the pump will freeze and we will have a lot of trouble with it. I would like to have his recommendation as to where the syphon should be charged.

CHAIRMAN ROBERTS: Where would you recommend, Mr. Vaughan?

MR. VAUGHAN: Inside of the mines at the summit of the syphon. That would be my idea about it.

CHAIRMAN ROBERTS: What does the chairman think of that?

MR. KNIGHT: Where weather conditions are likely to affect the syphon, I think that that is entirely correct.

CHAIRMAN ROBERTS: Could the committee prepare general specification covering that point and incorporate it in their report?

MR. KNIGHT: Very easily.

MR. EMENY: I might say that we had a little experience with the syphon recently and the very simplest way of putting the syphon into action, and the cheapest, is merely to attach an ordinary kitchen pump to the high point in the pipe. That exhausts the air as thoroughly as anything else. With a short pipe it does it very thoroughly and very satisfactorily indeed.

CHAIRMAN ROBERTS: You see, gentlemen, how much good we get out of discussion and the way we perfect reports that have been prepared with the great care that has been devoted to this report. We are all anxious to make this report as perfect as possible.

MR. QUARRIER: The only thing I have to say about the syphon is that it is a bad thing to recommend to anybody. It is very costly. A little chunk of slate will put it out of commission and it will take hours to find where your trouble is.

In locating the point of starting the syphon, it should be a little bit to the discharge end of the summit because your kitchen pump will draw the water up and you want that water to run over into the discharge end. The discharge end will have to be stopped. Then when you have got all the air out and are pumping water without any trouble, you can go down to the other end and open up your syphon and it will run if you have no other trouble.

CHAIRMAN ROBERTS: Do I understand from the statement that you would not under any circumstances install a syphon?

MR. QUARRIER: Not if I could do anything else. There are some circumstances where you have to do anything. You can't set up any rule that you would not install a syphon, but I would not recommend it to any friends of mine.

CHAIRMAN ROBERTS: Has the chairman any reply to make to that statement?

MR. KNIGHT: I think it is entirely dependent upon conditions. I think there are some cases where the syphon would be very useful and very economical. However, the point that I tried to bring out and perhaps did not bring out very clearly was that if you can't install a syphon right, you might as well not try to install it. There has to be a great deal more care in the installation of a syphon than in the installation of a pump.

CHAIRMAN ROBERTS: Would I draw the conclusion then, Mr. Knight, that where conditions are favorable, and if you know how to install it, then you could recommend it?

MR. KNIGHT: I would recommend it and I tried in the report to limit the recommendation. We recommended it under certain circumstances where the water could be handled, if it could be handled; without the initial expense of an expensive pumping equipment; the syphon might be better and more practical.

MR. WERT: I was going to speak along the same line as Mr. Knight. I am on Mr. Knight's committee. I have seen some syphons that worked successfully. As Mr. Quarrier says, sometimes you spend a lot of time getting them in shape but after you do, if you have a big body of water to remove, you can remove an immense amount of water with the syphon. As to the charging of it, I have seen them charged almost at the suction end. We have done away with a great deal of trouble by putting what we call a "stand-pipe" in. Of course in that case you want a valve at your discharge to close that, and this stand pipe, which will stand probably five or six feet higher than any other point in the pipe, will let all the air escape, and when the water begins to flow out of that, if your syphon line is tight, you are going to move a big body of water before it takes enough air to stop the suction.

COL. MILLIKEN: I don't know very much about this mine drainage and I would like to ask Mr. Knight a question if I may. If your conditions are right with a syphon and it is properly installed, is there anything that is more economical?

MR. KNIGHT: You are not consuming any power either in steam or electricity moving that body of water and further you have no interest or depreciation on your pumping equipment.

COL. MILLIKEN: Then it is an economical proposition?

MR. KNIGHT: Yes, provided it can be installed right and can be installed at reasonable expense. I know we had one particular case

that I have in mind where we were draining a portion of a mine which had been at one time, through bad judgment, pumped full of water from another portion of the mine, and we used pumps. We tried a small syphon unsuccessfully for a time, and finally we went to work and put in a larger syphon and put it in right, moving some slate and that sort of thing. Formerly we had been dipping and bending around and were coming out through an old entry that was pretty well gobbed up, and we had not gotten the syphon to work but when we did get it installed on a pretty good uniform grade and had eliminated the short curves, we drained that entire body of water in a comparatively short time and in a very economical manner.

MR. COLE: I regret that I did not hear the first part of this very comprehensive report but it seems to me that a little something added as an appendix on the priming of pumps would be pertinent. We have to send out service men repeatedly and go to considerable expense. We find it is simply a matter of priming. A little education in this line will go a great way toward saving big losses and expense on the part of other people. Any other data in the line of taking care of ordinary pump troubles, put in a comprehensive form, I think would also be of value.

CHAIRMAN ROBERTS: Is there any further discussion of this report?

MR. LANDIE: Before we get away from the syphon proposition, I have seen numerous cases where it was the best thing that could be used. In fact there are quite a number of them in use in West Virginia today. In some gaseous sections of the mine where it is unsafe to try to lay the wires and you don't have too much slate falling, we have installed quite a number of these syphons, which keep down the water, and thereby avoid any interruption of the ventilation. I have seen syphons work for eight or ten months without being charged. I have seen them working on different pumps by means of floats, so I don't think it would be out of the way to recommend them.

CHAIRMAN ROBERTS: Did you hear the entire report read?

MR. LANDIE: Yes.

CHAIRMAN ROBERTS: Have you any recommendations for any additional specifications that would help to make the syphon more safe to install so that when the Committee recommends them, they will add sufficient specifications for the man who is not experienced. You gentlemen have had experience, but there may be occasions where an engineer is a good mine drainage man but has never had any experience with the syphon. Now he wants to know how to install one. Let's make it perfect enough so that this man who has not had the experience that you and Mr. Knight have had can install the syphon and then it will work and he won't come back and say, "Well, that committee recommended something bad."

MR. LANDIE: Before this Special Committee meets I will give Mr. Knight a few points on what I have seen in actual operation.

CHAIRMAN ROBERTS: My idea was to give actual methods of installation and operation for each and everything that you recommended, enough in detail to guide the average man, not the expert.

Is there any further discussion on the paper? If not, we will now refer this paper to the Special Committee.

We will now call on Dr. Payne, Chairman of the Committee on "Outside Coal Handling Equipment."

DR. H. M. PAYNE: The Committee is unable to render a complete report on all of the items before it, because the Bureau of Mines now has in preparation certain recommendations which we desire to go over and to incorporate. We want to coordinate those with a recent publication of the United States Steel Corporation and with the recommendations of the National Safety Council and the different coal mine rating bureaus.

On that account, therefore, we can only make certain definite recommendations and the others will have to go over until the later report.

REPORT OF THE COMMITTEE ON OUTSIDE COAL HANDLING EQUIPMENT

It is understood that brakes and other features of mine cars, as well as safety track devices for these cars above ground, will be covered by the sub-committee on Underground Transportation.

THE FOLLOWING RECOMMENDATIONS ARE OFFERED.

(1) In the matter of safety blocks and stops for inclines, it is recommended that all shafts, slopes and inclines shall be provided with safety blocks or derails, which shall positively prevent cars from passing into or down such places except when under absolute control. Such blocks or stops shall be so arranged that they shall protect, except when manually held in operative position.

(2) It is recommended that the handling of railroad cars under the tipple be either positive or negative, and not neutral, i. e., in the case of a flat grade, the cars should be pulled under the tipple, or in the case of an inclined grade, a car retarder should be used, and in no case should cars be permitted to run free.

(3) The committee recommends that all cages used for handling men shall be equipped with gates, as is already common practice in metal mines and in many coal mines.

(4) The committee further recommends that all shaft landings be equipped with vertical sliding gates not less than six (6) feet high, which shall be opened automatically when the cage stops at the landing, and be closed automatically as soon as the cage leaves the landing, either ascending or descending.

(5) It is recommended that a standard system of signals for hoisting and lowering be adopted by all mines, said code to be based on the codes now most generally in use, except where state laws specifically require otherwise.

(6) The committee recommends that loading booms shall be counterweighed, and shall also be provided with such safety devices as will eliminate danger from dropping through breakage of supporting cable, or when not in use.

(7) The subject of Standardization of sizes of shafting and pedestals being already under consideration by the American Society of Mechanical Engineers, it is recommended that this Committee confer with the corresponding committee of the American Society of Mechanical Engineers and make joint report at a later date.

(8) It is recommended that during the coming year, this Committee work out standard belt and gear combinations in

connection with drives for tipple machinery, such as picking tables, shaker screens, jigs, inclined conveyors, etc. with the object of reducing the number of sizes of such items.

(9) In conclusion, it is recommended that during the next year, the forthcoming publication of the U. S. Bureau of Mines, the hand books of the U. S. Steel Corp., the Safety Standards of the National Council, and of the various Coal Mine Rating Bureaus, and any others obtainable, be jointly digested by this committee, unified, and presented as representing standard practice in the matter of Safeguarding Machinery. Belts, and Shafting, Railings, Toeboards, Stairways, Ladders, etc.

Respectfully submitted,

Henry M. Payne, Chairman.
G. F. Osler,
W. A. Bishop,
F. W. Whiteside,
Jas. Needham,
F. G. Morris,
W. J. Patterson,
M. A. Kendall,
Warren R. Roberts,
Rudolph H. Kudlich.
Hubb Bell, Representative
American Society for Testing
Materials.

CHAIRMAN ROBERTS: This is a very brief report, but is composed entirely of good recommendations. I don't know whether you can keep all of these in your minds or not, for there are nine recommendations but you likely have some particular thought that it has brought to your mind. If there are any of these recommendations that you want to question or add to, we are ready to hear from you.

MR. CASEMAN (New Mexico): I have the same thought that was raised in connection with the other report. The gentleman made the statement that three-fourths of the signals used in the United States were the same signals. I would suggest that that code be incorporated in this report, so that when it goes out over the country we will not only know that three-fourths of the people of the United States are using those signals, but that we will also know what those signals are.

In our state I do not think we have a law on that subject, but I think the State Coal Mining Inspector has issued instructions on the subject. If ours are at variance with those that are conformed to by a majority of the people, we would know it when we get this report.

DR. PAYNE: In that connection, Mr. Chairman, I could say that we wanted to do that very thing. Unfortunately, as Chairman of the Committee, I have been out of the United States for the last two months and just returned. I suppose that is really one reason why we were unable to use some of the data that has been carried over.

I said three-fourths; perhaps it is five-eighths—I don't know just what proportion—but certainly a majority of the states do have standard signals. We came to that conclusion from the fact that you and I all know that whether we go into Illinois, or Kansas or the State of Washington or West Virginia, it is the exception when the hoisting or lowering signal on the cage is not the same as we use at home.

We know that the great rank and file do use those signals. I believe it would be a little unjust, however, and possibly somewhat prejudicial to the uniform adoption of those if we were, at this stage of the game, to come out with an arbitrary statment, "These are the signals you ought to use." I believe it would be conservative judgment for us to let that go a little while until we can get all the state mine laws and digest the matter very thoroughly and make a safe and conservative recommendation.

CHAIRMAN ROBERTS: Is there any further discussion of this paper? We want the very freest of expression regarding all the recommendations made by this Committee.

If there is no further discussion at this time, we will refer this to the Special Joint Committee with the transcript of the discussion.

We will next consider the report of the Committee on "Standardization of Mine Ventilation," of which Mr. Montgomery is Chairman. In his absence his associate, Mr. Trik, who has helped prepare this report, will read the report and lead the discussion. Mr. Trik.

REPORT OF COMMITTEE ON MINE VENTILATION

Owing to the fact that the members of this Committee were distantly located from each other, we found it impossible to get together for a meeting. Our only feasible method, therefore, seemed to be through the medium of a questionnaire. The replies received have been compiled, and having been approved by the members, are made a part of this report.

Since mine fans must be built to meet various conditions found in the mining field, the question of standardization is considered impractical. Your Committee, therefore, have confined our recommendations to improvement and practices of Mine Ventilation which is Standardization in its broader sense and conforms to the instruction issued by the General Committee, knowing that the details of standardization would in due time naturally follow.

It is with these fundamental principles in view that we submit to your Congress the following recommendations with the hope that they will receive your careful consideration:

MINE FAN INSTALLATIONS

Many mines are still ventilated with inefficient fans and furnaces. The loss, due to wasteful power consumption, runs into many thousands of dollars and in spite of this tremendous waste, many operators, apparently unmindful of the great improvements in mining methods, are continuing to install these ancient types of ventilating equipment.

The old wooden housed fans are a source of great danger to those employed in the coal mining industry. The effect of inadequate ventilation has much to do with the health of the miners, the maintenance of the mine and the production of the same. We have had costly warnings during the past few years of the great necessity of utilizing every means to raise the standard of mine ventilation to a higher plane. A good supply of

fresh air in a mine is very essential and no money expended brings better returns than the expenditure in establishing and maintaining a first class system of ventilation. It is therefore recommended:

EXPLOSION DOORS

That all mine fans at gaseous mines shall be so set as to be out of the direct path of an explosion, and that explosion doors be provided for the relief of pressure prior to its reaching the ventilating mechanism.

AUXILIARY DRIVE

That at all gaseous and large shaft mines under heavy cover and without the benefit of additional openings at points on the outcrop, an auxiliary drive be provided.

TEMPORARY FANS

That if a temporary fan is installed at a new mine, it should be so located that the installation of the permanent fan will not interfere with the ventilation.

PRESSURE GAUGES

That all fan installations be equipped with a regular "U" tube water gauge and a recording gauge.

DOUBLE INLET

That double inlet fans are recommended for all fan installations unless local conditions or ventilating factors make such installations impractical.

EVASEE CHIMNEY

That all fans used as exhaust shall be provided with evasee chimneys, so arranged that the air will be discharged vertically.

FIRE PROOF

That all fans be made fire proof. No combustible material should be used in the installations.

OUTLET VELOCITY

That the pressure due to the outlet velocity into the open atmosphere shall not exceed 7½ per cent of the water gauge against which the fan is working.

INTAKE VELOCITY

That the pressure due to the velocity into the inlet of the fan shall not exceed 7½ per cent of the water gauge against which the fan is working.

REVERSING

That all fans for gaseous and large non-gaseous mines be so constructed that the air may be readily reversed.

KNOWN CONDITIONS

That the air shall not be reversed under any circumstances unless conditions inside of the mine are thoroughly known.

FAN CAPACITY

That at mines where the ultimate volume of air to be circulated is approximately or definitely known, or at mines which have reached their development, fans should not be installed with a capacity of two or three times the need or capacity of the mine. On the other hand we do not recommend small fans which must be run at a high speed simply to produce a great depression to draw the air through themselves, see headings: "Intake and Outlet Velocity."

TYPE OF MOTOR

That where moderate to large fans are electrically driven, a slip ring motor should be used. Starting duty on a fan is severe and with the use of a slip ring motor, it can be accelerated gradually which is impossible with a squirrel cage type.

POWER SOURCE

That wherever possible the driving power for the auxiliary equipment should be from a different source than that for the main drive, especially so if electric drives are employed.

BELT CENTERS

That where belt driven fans are used the distance between centers shall not be less than three times the sum of the pulley diameters.

BOOSTER FANS

The Committee has given very careful consideration to the installation of booster fans in mines. It recognizes that much prejudice exists against the use of booster fans but we believe this is due to a lack of knowledge in regard to the function or application. This type of fan is used very extensively in foreign countries; in fact, the ventilation of mines in some countries is so difficult that it is really impractical to get along without booster fans. Our mines are much more easily ventilated in general, but we do find the development of some mines which calls for a booster fan to properly ventilate a remote section without increasing the total ventilating pressure on all splits. It is not our purpose to endorse this type of fan simply to remedy a clogged air way or water filled entry which should be taken care of by other means.

In order to illustrate this very important point let us assume that the fan on the outside has a normal capacity of 80,000 cu. ft. at a certain speed and the mine is divided into four districts or splits which require 20,000 cu. ft. each. Now the resistance

in one long remote split is such that only 10,000 cu. ft. will pass at the pressure necessary for 20,000 cu. ft. in other splits or districts. Here is where a booster fan is practical, economical and recommended. The pressure can be raised on this split and the 20,000 cu. ft. circulated without increasing pressure on the other districts or increasing the speed of the fan on the outside.

If an attempt had been made to properly ventilate this remote split by increasing the speed of the main fan, it would have required double the present fan speed, placing regulators on the other three splits and delivering the 80,000 cu. ft. against four times the present pressure, therefore increasing the power consumption at least four fold or more. The following recommendations are proposed for the booster fan:

INSTALLATION

That they are recommended for use in mines to properly ventilate a remote district which cannot be ventilated by the outside fan without greatly increasing the fan speed.

FIRE PROOF

That the fan installation be made absolutely fire proof and the brattice between the intake and discharge of the fan be constructed of noncombustible material.

BY PASS

That a by-pass door be constructed in the brattice of ample size to permit the air to pass without passing through the fan. This door should always swing in direction of air current.

SELF STARTING

That the motor driving the fan be fitted with an automatic starter totally enclosed in steel box.

CENTRIFUGAL BOOSTER

That where a booster fan is necessary in a mine, usually considerable pressure is required, therefore, a centrifugal type is best adapted.

AIR WAYS

The relation borne by the mine resistance as expressed in inches of water to the power bills for driving the ventilating apparatus is generally well understood by the operator and yet well in the face of this knowledge we are constantly finding an apparent utter disregard of this important fact.

It is no uncommon thing to find a large mine whose development has not progressed beyond three years requiring a 2 inch pressure to pass 100,000 cu. ft. through it. No better indication could be had that the operator's main object was to get a large tonnage and everything else has gone by the board to that end,

and for this neglect of his airways he is bound to pay dearly in the future. If a mine only three years old requires a 2 inch pressure to ventilate it one can readily see what the pressure requirements would be as its life grows longer, the volume required becomes greater, and the air courses are held in the same disregard.

It is the duty of the mine Superintendent, Foreman and Inspector to keep a watchful eye upon the mine resistance and in the interest of good ventilation and economy see to it that all airways be as large and kept as clean as possible.

We feel that this disregard for an important fact is due not so much to willful neglect as to a mistaken idea on the part of the operator as to the apparatus used to ventilate the mine. Briefly, many operators believe it cheaper to let their air courses become clogged and dirty and purchase a new fan when more air is needed. But this is absolutely a misconception of the characteristics of a fan. For be it known that no fan—no matter what its size or make—can deliver more air into the mine at the given pressure than the old ones.

The mine resistance or water gauge is a characteristic of the mine and is in no way governed by or has anything to do with the fan whose sole duty is to run at the proper speed necessary to produce the pressure and volume as called for by the mine characteristics.

The following table clearly emphasizes the importance of maintaining large airways at all times during the life of the mine.

FORMULA—POWER VARIES AS: $\frac{\text{CUBE OF AREA}}{\text{PERIMETER}}$

Size of Airway	Perimeter	Area	Relative Powers making Airway 10x10=10 H.P.	Cost per H.P. per year at 1½c K. W. H.
10x10	40	100	10	$ 980.00
8x8	32	64	30.5	2,989.00
7x7	28	49	59.5	5,381.00
6x6	24	36	128.5	12,600.00
5x5	20	25	320	31,360.00

It will be noted from above table that if it requires ten H. P. for an airway of one hundred square feet it will require about six times this amount for an airway one half this size. The average mine requires about 90 H. P. for its ventilation. Assume the area of the airways as doubled, then about 15 H. P. would be required effecting the saving of 75 H. P.

The system of splitting the air is not carried out extensively as it should be. There are many mines today in which the current is carried in one continuous column from the intake to the outlet. This system is not only very difficult and expensive to maintain, but is a dangerous practice. In case of an explosion the whole mine would be endangered, but if the mine were ven-

tilated, in districts, the effects of the explosion most likely would be confined to a small part of the workings. The splits should be made as near the intake and the several branches reunited as near the outlet as possible.

The proper distribution of the air through the workings requires a thorough knowledge of the subject. There are few matters connected with the mining industry that require greater skill and ability than the proper coursing of the air. A very slight oversight in the distribution of the air may make all the difference between good and defective ventilation. This important work should be placed in the hands of experienced men who are backed up by a certain amount of scientific knowledge on the subject. They should be conversant with the composition of gases, the laws which govern the flow of fluids, and a practical knowledge of the operation of the mine fan is indispensable. Therefore, the recommendations for airways are as follows:

STRAIGHT AIRWAYS

That all airways be driven straight and where changes in direction are necessary that they may be made wherever possible by long radius curves.

EASEMENT

That an easement be provided at the bottom of the fan air shaft to enable a change of direction with a minimum of shock.

CLEAN AIRWAYS

That all airways be kept clean and free from the accumulation of falls, mine cars, timbers, as far as it is found practicable to do so.

OVERCASTS

That where overcasts are used in the airways the bridge be of such size that velocity will not exceed 1000 ft. and that an easement be provided on each side of the bridge.

AIR SPLITS

That in the interest of both safety and economy, the air be divided into several splits rather than forced to travel in one continuous current and that each split shall have not less than 20,000 cu. ft. of air in any mine which has gas that exceeds 0.5 per cent.

STOPPINGS

That all stoppings be made air tight as far as found practical to do so. Should be built of fire proof and durable material and frequently inspected. Piling of gob against stoppings should be avoided as it prevents inspection.

OLD WORKINGS

That the air shall not pass thru old workings, giving off gas, to new workings. Air passing out thru old workings must be of sufficient volume to keep temperature of gob at a safe point.

REMOTE OPENINGS

That as far as practical to do so, the air should be brought in or discharged from openings remote from the fan.

MULTIPLE ENTRIES

That where the size of the mine requires it, the multiple entry system should be used.

CROSS CUTS

That a change in the laws governing cross cuts be enacted permitting main entries which must be maintained thruout the life of the mine, to be driven two hundred feet or more before a cross cut is made. The ventilation of these entries to be accomplished by means of small auxiliary fans and air current carried to the face thru tubing or by brattice lines.

This method will insure a copious supply at the face at all times, reduce the cost of making numerous cuts and building stoppings, prevent a vast amount of air leakage and short circuiting and in turn greatly reduce the volume of air the permanent fan must handle with a corresponding decrease in power consumption.

AIR SPLITS

That the engineer when laying out the mine, shall wherever possible have the splits made close to the intake and bring them together again as close as possible to the outlet.

INLET AND OUTLET

That there should be as free and unobstructed inlet and outlet for the air as far as it is found practical to provide same.

MINE TRACKS

That the mine tracks in the main airways leading to the fan should not be removed. The tracks being available, readily permits the airways to be kept clean.

WATER GAUGE

That the water gauge should be kept as low as possible, but the airways should never be permitted to get into a condition to require over 3 inch gauge to properly ventilate any mine.

AIR VELOCITIES

The question of airways and air velocities are practically indivisible, inasmuch as the velocity of the flow of air is entirely dependent upon the size and condition of the airways.

It is sectional area alone which governs the velocity of the flow of air. A certain airway may be clean and free from obstruction, yet their sectional area may be so small as to cause such a high velocity that the consequent increase in frictional resistances causes the fan to generate a head that is entirely too great for the volume passing and so represents a true loss in power consumption.

High velocities not only cause a useless consumption of power, but other more important results are caused by this unsatisfactory condition. It will be found in mines having high velocities in the airways that unhealthy and dangerous conditions exist at the face of the workings. This is due to the fact that the air carries in suspension the dangerous dust particles in great quantities at high velocity than at a slower velocity, and these are carried back to the live workings. It is also noted that during the winter months when the intake is on the haulage, a high velocity greatly aggravates working conditions. It is therefore, recommended as follows:

MAIN ENTRIES

That the velocity in the main entries shall not exceed 800 ft. per minute.

WORKING FACES

That the velocity at face of the working shall not exceed 300 ft. per minute.

SHAFT OR DRIFT

That the velocity pressure in the air shaft or mine drift shall not exceed 7½% of the water gauge against which the fan is working.

GENERAL

There are other factors which enter into the ventilation of mines for which your committee has not made recommendations due to the fact they are governed by local conditions and do not apply in general to the ventilation in different coal fields. As for example the use of blowing or exhaust fans. Each system has its advantages and disadvantages and the committee feels its duty to point out these and leave it up to the operator to apply the system best adapted for these particular requirements.

The exhaust system has its advantages and some very distinct ones. The haulage road where most of the travel is done is kept free from gas and smoke and permits the men to perform their work in fresh air. The stoppage of the fan will not permit the gas from the gob to find its way to the mine workings, for the mine pressure is increased. One of the main advantages claimed for the exhaust system is it will clear the mine of gas much quicker than a blowing fan. In case of old mines where a blow-

ing fan required from four to six hours to clear the mine of gas, when the fan had been stopped only twenty-four hours, it is claimed with an exhaust fan the mine could have been cleared of gas so that the fire boss could have gone in and made an examination, in less than an hour. The reason for this is the blowing fan carries the gas out of all the old workings and pillar falls, etc., onto the main haulway, while with the exhaust fan all the gas from the mine's old workings, pillar falls, etc., go directly to the airways leading to the fan. Almost as soon as the exhaust fan is started, the fire boss can follow the fresh air into the face of the mine workings. There is also an advantage for the exhaust fan in case of explosion. It enables you to proceed with rescue work with greater dispatch, that is, the intake is on the haulage road which affords easy means to convey brattice material to repair stoppings, etc.

The exhaust system has its disadvantages. There is usually more or less broken coal, and dust in a shaft tipple and scattered along the haulage road and with the intake on the haulage road—these particles are carried back to the live workings which is not only a source of danger but makes the air more unhealthy. The intake air cannot be heated and humidified as conveniently with exhaust system as with the blowing system, without the use of doors on the haulage road. If doors are used then there is more or less fog produced which greatly interferes with the haulage system as men could only see a short distance ahead. The cold air in the winter would have a tendency to freeze up the hoisting shafts or intakes, and also make it very uncomfortable for the men working near the intake.

The blowing fan has a distinct advantage relative to protection of the mine during the winter. If the air is sufficiently heated, that is, if its temperature is brought up to mine temperature, the ventilating current will deposit moisture, wash the air and relieve it of the dust particles which are always present. With a blowing fan the temperature can be kept about the same during the winter as it is in the summer. An even temperature prevents roof-falls and moist mine would prevent mine fires as all combustible material would be kept thoroughly saturated. One advantage the blowing fan has and which is infrequently referred to, is where the mine has not a very heavy strata overlying the coal, and which is broken more or less by drawing pillars and ribs. The blowing fan will force out all contaminated air in these openings, whereas, an exhaust fan will draw it through the mine. There are other advantages for the blowing fan, such as keeping the haulage roads and hoisting shaft free from ice in the winter and more comfortable for the men. If a fire should occur in any part of the mine, it is made evident to the men working in return current.

The blowing fan has also its disadvantages. The gas, smoke

and all impurities travel on the haulage road. Gas has been known to accumulate in a pocket in the roof and cause an explosion on the haulage. If the fan is stopped for any length of time, the pressure on the mine is relieved, that is, with a blowing fan the mine pressure is above atmospheric pressure, and the stoppage of the fan enables the mine to give off gas more rapidly and allows it to find its way out into the live workings.

The method of driving fans is another important subject but it is governed entirely by local conditions, whether steam, electrical or other power is available. If steam is used then the question is whether to use direct connection, belt or rope drivers and this is determined by the volume of air handled and pressure against which it is delivered. In general we might say that where a maximum volume of 100,000 cu. ft. or less is required, delivered against a mine resistance of 3 inch water gauge, it is frequently found advantageous to use rope or belt drive, otherwise it would be necessary to provide a fan of larger diameter and capacity than the mine requirements demand to stay within the safe and economical speed of engine for direct connection.

Where electrical power is used the drive may be a belt, rope, or chain. Direct connection to a motor is only practical where a small volume of air is required and slow speed motor is used unless a reducing gear is provided between the fan and motor. Great care to be exercised in direct connecting fans and motor especially on a new mine where an increase of fan speed is required from time to time.

There are other items relative to the ventilation of mines such as whether to install permanent or temporary fan at a new mine, install permanent or temporary drives, etc., are dependent on factors which at times would call for the adoption on one, at other times to pursue a different course.

CONCLUSION

It is our opinion that a system of educational work should be started relative to the operation and duties performed by mine fans. There appears to be a woeful lack of data and knowledge of the subject. Hundreds of mine fans are condemned by their users as well as by many mine inspectors simply because the mine will not pass the air at a reasonable pressure. The fan may have a normal capacity of 200,000 cu. ft. at 3″ gauge but the mine capacity is only 100,000 cu. ft. at 3″ gauge, hence only 100,000 cu. ft. is obtained at this pressure. The mine acts as a regulator on the fan, therefore no matter how large a duty is specified for the fan only 100,000 cu. ft. is obtained at 3″ gauge.

We do not mean that this educational work should be carried on by the Standardization Committee, but it belongs to the Bureau of Mines. This bureau has done excellent work along most all lines pertaining to the mining industry but we do not

find any educational work pertaining to the operation of mine fans, splitting and distribution of air, size of air ways, shafts, etc.

Respectfully submitted,

W. G. MONTGOMERY, Chairman.
G. E. LYMAN,
E. N. ZERN,
MARTIN J. LIDE,
J. H. DOUGHTY,
H. N. EAVENSON,
J. C. GASKILL,
E. B. WAGNER,
C. E. SHARPLESS,
H. B. WRIGHT.

CHAIRMAN ROBERTS: You have heard the report of the Committee on Mine Ventilation. It must certainly impress you with the vast amount of work that this Committee has necessarily had to do to give you this report.

I happen to know something about mine ventilation myself, having been installing ventilating equipment for some 20 years. In the early stages of my career I used to look around for data that would help to educate me on the proper ventilation of a mine, and I read many of the supposed treatises on the subject, most of which were antiquated, and others that were good theoretically but the men who wrote them knew very little about the ventilation of a mine.

I can truthfully say that all the treatises that I have ever seen on mine ventilation put together didn't have as much good working material to guide a man who wanted to install a proper ventilating system in his name and properly lay out his mine for ventilation as this one paper.

The Committee has tried to lay a great deal of stress upon the fact that the all important thing is to properly lay out your system of ventilation and then maintain it, if you want to economize in the ventilation of your mine.

When I first went into this business some 20 years ago there used to be a great deal of bunk connected with mine ventilation and there were actually in the business at that time some men traveling around the country selling fans who tried to persuade the superintendents and men at the mine that there was a very great deal of mystery and secrecy about the ventilation of a mine and that it just took a certain kind of a fan to ventilate that mine, and that the man who discovered that secret and had that particular fan had a cinch on the business. I know men who were traveling around over the country selling fans on that basis; they had some new kind of a fan that was different from the standard fans that were on the market.

This Committee has drawn the conclusion for you that if a mine is not properly laid out, to take 100,000 feet of air against a three-inch water gauge, no fan can put over 100,000 feet of air through those air ways without going above a three-inch water gauge. I have heard superintendents state that they had a fan that would ventilate any mine. They didn't know the first thing about ventilation and did not know that this fundamental statement was absolutely correct, that no fan could put more air through that air way than it was then getting without raising the water gauge. They thought there was some mystery about it and that their particular fan could do the trick.

While there has been a great improvement due to the higher class men who have been marketing fans and helping to educate the mining

industry in the proper laying out of their mines, there is still a great deal of room for improvement. This report, if it is backed up by the American Mining Congress and given to the industry, will help to put forward a long way the ventilation of mines, and accomplish the two fundamental things—give them the proper amount of air for the men in the mine as a matter of health; and second, produce that air at the least possible cost.

That is the whole thing in the ventilation of a mine.

There are two questions that occur to me, which I would like to ask before we open the discussion. I don't quite understand, myself, what the Committee means by "The remote openings." Explain to the audience what you mean by that statement.

MR. TRIK: You find very often that they have air shafts that are split and the intake is on one side and the air is brought down through one shaft and through the mine and up the other side of the very same shaft into the fan. We mean, as far as practical, if you can get the air shaft on the other side of the mine, then bring it through the mine and to the fan. For instance, in an anthracite mine you will find that the anthracite coal outcrops a great deal. That is a very desirable thing because then you can put your blowing or exhaust fan wherever you choose and use the outcrops as intake for your fresh air.

CHAIRMAN ROBERTS: But in a shaft mine, of course the air will go in one shaft and out the other.

MR. TRIK: Yes. It very often means driving another shaft.

CHAIRMAN ROBERTS: On page twelve you say, "With a blowing fan the temperature can be kept about the same during the winter as in the summer." Explain what you mean by that.

MR. TRIK: You will find very often that operators use exhaust steam. They blow this steam into the air shaft to temper it and in that way the temperature of the fresh air entering the mine is brought nearer to the mine temperature.

CHAIRMAN ROBERTS: You meant then by artificial means?

MR. TRIK: Yes.

CHAIRMAN ROBERTS: Now then, gentlemen, the report is open for discussion. Does any one have any inquiries to make?

MR. J. H. EDWARDS: The report made a recommendation regarding the length of centers for the drive. I think it was three times the sum of the diameter of the pulleys. Well that naturally would rather imply then that that long belt center drive was recommended. I believe that some mention should be made of the success of the short drive with an idler, because some companies that I know of are coming to that drive.

MR. TRIK: Mr. Chairman, I have nothing to say further than that that has been a thumb rule that we have used. We have found that the long centers have been advantageous, but where companies are willing to use an idler there is absolutely no reason for doing it. It is merely a thumb rule that we have used for long centers which are by far in the majority.

CHAIRMAN ROBERTS: You meant that would be the rule where no other means has been used.

MR. TRIK: Do you mean to recommend that an idler can be used?

MR. EDWARDS: Yes, or at least mention it. You ought to mention it.

The people that I am with are operating 24 mines, and practically every one of them has a long belt center drive, and most of those were put in by rule of thumb and conformed to that rule. However, an investigation showed this: due to the belts not being kept at proper tension, due to lack of belt dressing or due to lack of proper pulley, in most cases the drive was very bad, although it did conform to that ruling. As a result of that on the newer mine fans, the larger ones, the idler was resorted to, not only because it was felt that they would have a better

drive for all time, but also the saving in the cost of construction of the building more than paid for the idler.

CHAIRMAN ROBERTS: We might suggest, of course, that an engineer can take into consideration in his original installation (especially of a very high grade equipment for large mines) that, to economize in construction, he may be warranted in putting in a silent chain drive and making his drive very close. There are methods that I think could be inserted that would make that item a little clearer.

Is there any other discussion?

MR. J. A. EDE: One of the difficulties that we experienced in our mine was that the Mine Manager would give us one computation of the air that was traveling and the Mine Inspector would give us another. In order to standardize it, I had standard measurements put in at least two places in the mine, which represented the orifice of the mine and one near the bottom of the shaft. I had that measured carefully so that we could ascertain the extension.

After placing those we never had any more trouble. The inspector would go in and we found a very close relation between the Mine Manager and the Mine Inspector. However, before that, it was different. We are mining on the long wall system; in some cases the opening would be very large, and perhaps the inspector would take it there where perhaps the air didn't appear to be traveling fast and the Mine Manager would take it perhaps in a small place, with the result that there was a discrepancy; but having standardized it, as I have indicated, we have had no further trouble of that kind.

CHAIRMAN ROBERTS: Is there any further discussion of this report?

MR. RUDOLPH KUDLICH: I would like to call the attention of the Committee, when they get to work on this, to the fact that the Power and Transmission Committees have also made some recommendations with respect to the electrical installation of your surface fans, and also covered the auxiliary drive. In some of the mines it is quite difficult to put in the auxiliary drive, and we have given them the alternative of providing signals to warn all the men out of the mine in a very short space of time.

Another question I wished to bring up was in regard to booster fans in the mines. I think it would be well for the Committee to cover the case of booster fans in gaseous mines. The only mention Mr. Trik has made is with reference to closing the starting switch in the steel cabinet. What those recommendations would be I haven't the least idea. I am just offering that as a suggestion.

MR. L. D. VAUGHAN: Mr. Chairman, I think it is an excellent report on ventilation; it is fine, with one exception. Of course when it comes down to the mechanical way of equipping a mine with electricity I know but very little about it, but he does not make mention there of anything but electricity for the power of driving the fan. I think, in gaseous mines, shaft mines, that all the fans should be driven by steam. He does not mention that in his report. For the safety of the mine and the men I think that should be done.

CHAIRMAN ROBERTS: As I remember the report treats that in a negative manner in this way: he does not ignore a steam drive, but he says, negatively, that if electricity is used, then you should do so-and-so, assuming that if you had used steam you did not need to do that, because that is a positive safety appliance.

That was your thought, Mr. Trik?

MR. TRIK: Yes, sir.

MR. L. D. VAUGHAN: If you want to standardize the matter, we should say that fans for all shaft mines should be driven with steam; otherwise some fans in shaft mines would be driven by steam and others by electricity.

MR. TRIK: Then you positively recommend, arbitrarily, that all fans be steam driven?

MR. VAUGHAN: Yes.

MR. TRIK: You would be out of luck in West Virginia.

CHAIRMAN ROBERTS: Possibly these gentlemen don't understand you. Make yourself a little clearer, Mr. Vaughan, as to what mines in particular you think should use steam for the fan drive.

MR. L. D. VAUGHAN: All gaseous mines.

CHAIRMAN ROBERTS: That fans for all gaseous mines should be driven by steam power?

MR. L. D. VAUGHAN: That is my recommendation.

CHAIRMAN ROBERTS: The Committee will take that under consideration.

MR. SIDNEY J. JENNINGS: I would like to point out that there are some coal mines that derive their power from central power stations, either hydro-electric or electricity generated by steam, and they have no steam in their mines at all. It would be an injurious recommendation, under those circumstances, to have a steam-driven fan, and I don't think it should go out as the recommendation of the Committee that any particular form of power should be used, but that a perfectly safe thing should be recommended.

There is one other thing that I would like to bring out. No quantity of air was prescribed or recommended. Several of the states have laws which recommend one volume of air per man per minute, and so many cubic feet per animal. It seems to me that is a point the Committee could take into account; and also in gaseous mines they should take into account the amount of area of coal exposed, which is liable to give off gas and should be considered in determining the amount of air per minute that should go into the mine.

CHAIRMAN ROBERTS: I think those are very good suggestions and the Chairman will be glad to make note of them.

MR. KNIGHT: It has been my understanding, Mr. Chairman, (while I have had no experience really with steam-driven fans myself) that the principal reason for the use of a steam-driven fan was that the supply of electricity, if used, was likely to interrupt. The constant ventilation of the mine was sufficiently important that the reason they desired to use steam was that it was considered a more reliable and constant source of power. That is to say, it was not subject to interruption.

In many cases, even where they have a steam plant, the transmission of steam to the location of the fan may not be economical, and it is my understanding that, in some cases where the matter seems important enough and they want to be absolutely free of interruption, that little separate steam plants have been set up purely for the operation of fans.

CHAIRMAN ROBERTS: That has often been done by men who had not reached the point where they had a lot of faith in electricity. It is gradually coming to the point where we have more faith in electricity. Why? Because the men who have furnished the electrical equipment and the lines, etc., are trying to meet that very requirement because they want electricity used. When I am opening up a mine in a certain locality and electricity is available, we take up with them right away that very question. If they say they can furnish us current for hoisting and ventilating, we want to know all about every detail of the power plant, where their lines go and who takes power from them. Any engineer who is going to depend upon that power to hoist his coal and ventilate his mine will look into that with a great deal of care, and if he is not satisfied, he will put in steam.

The Committee, of course, didn't intend to touch on those things at all. That was up to the engineer installing the equipment. It might be well to have some discussion in the report on such matters. They stuck more to the fundamentals in this first report. This is the report that is to

open up the subject and give it to the industry, and they had purposely and properly stuck to the fundamental things that would guide a man in laying out a properly ventilated mine.

DR. PAYNE: It seems to me we have side-stepped the point which the gentleman brought up about the use of electricity for shaft mines which generate gas. Perhaps I am wrong. However, I infer that his reason for bringing that up was the danger of using electricity. If that was the case and not the question of the steady supply of power from steam, then it seems to me, in the last two or three minutes, we have been side-stepping the real point that he brought up.

If I am correct, in answer to that, it seems to me that electricity at the present time and as recommended by this Committee with the safeguards that they have provided—explosion doors, etc., is just as safe as steam.

CHAIRMAN ROBERTS: Is there any further discussion?

MR. KUDLICH: In regard to Mr. Jennings' suggestion concerning the area of the coal exposed: it occurs to me it would be better, in connection with recommendations where gas is concerned, to make recommendations concerning the maximum amount of methane in the exhaust air from the mine rather than the area of coal exposed. One mine would generate a large amount of gas from a small area of coal exposed, whereas another would generate a very small amount.

CHAIRMAN ROBERTS: The Committee will take that under consideration.

If there is no further discussion, we will close with this paper, and refer it to the Joint Committee together with all of your discussion.

I wish to announce the Committee on Resolutions that was authorized at the forenoon session. With the permission of these gentlemen, I would like to name the following on our Resolutions Committee: Mr. Kudlich, Mr. Trik and Mr. Lee. Will those gentlemen kindly serve on that Committee? They will receive and consider any resolutions that are handed in in writing, so that if any member has any resolutions he would like to get through to the general Resolutions Committee of the Convention, please hand them to any one of these three gentlemen and they will take them under advisement and report back to us.

We have one other very fine report on Underground Transportation including three sectional reports from the three sectional committees. It is a big subject and I thought, at this tag end of the day, you would be tired and we had better start in on that fine big report at our next session. I will have to leave now. If it is your wish to go on with this report, I will appoint a Chairman to continue the meeting.

MR. MILLIKEN: While this report is rather long at the same time I don't think it will take a great length of time to present it.

CHAIRMAN ROBERTS: Then I will appoint Col. Milliken as Acting Chairman of the meeting, since he is going to present the report. Remember, Colonel, besides the general report, there are three sectional reports. I have them all here if you want to refer to them. I hope to get back before the meeting adjourns.

At this point Col. Jas. Milliken took the Chair.

ACTING CHAIRMAN MILLIKEN: Gentlemen, this is the report of the Committee on Underground Transportation. I am very sorry indeed that Mr. Watts was not able to attend the convention. Col. Roberts did his utmost to persuade him, and I have taken the matter up with him to the best of my ability. I think he is a good deal like the boy who stood on the burning deck—his father called him and he would not go because he felt his duty so. No doubt Mr. Watts felt it his duty to remain at Berwyn.

This report is really in three sections. The Chairman's report is quite small and after I have read that, I will give you just a synopsis of the sub-committee reports.

REPORT OF THE COMMITTEE ON UNDERGROUND TRANSPORTATION

During this year the committee has continued its activities in the field of its endeavors, with a spirit of great enthusiasm, taking advantage of the experience gained during the work of the previous year, seeking to enlarge and perfect its organization in such a manner as to best enable it to grasp the subjects to be studied in the most efficient manner, and to coordinate its work with other branches of its own organization, as well as with different Bodies and Societies engaged in similar or parallel lines of research.

In the discussion of the 1920 report the National Safety Council expressed a desire to cooperate more closely with the respective Committees of the Coal Mining Branch and I am glad to advise that we were fortunate in being able to secure a member of the National Safety Council as one of our Committee.

Several additional members representing both operators and manufacturers have also been added to our ranks during the present year, and all members have expressed their interest in the work and have given freely of their time and energies to this cause.

We regret to advise the death of Committee member, Mr. C. W. Larson, Engineer, General Electric Company, which occurred in January, 1921. By his death our Committee loses a most faithful and competent worker in the interest of Standardization.

On March 15, 1921, the sixth regular meeting of this Committee was held, at which time it was decided to go forward with the 1921 year's work based upon the recommended features contained in the previous year's report, viz., Track Gauge, Minimum Track Curvature, Wheel Base of Mine Cars and Overall Length of Car Body.

In order that each of the different subjects to be considered might receive thorough and exhaustive consideration it was deemed advisable to subdivide the work among different committees, thereby permitting each subject to receive the detailed attention of experts. The program for the year was therefore arranged to embrace the three subjects, as follows: Mine Locomotives, Mine Tracks and Signals and Design and Construction of Coal Mine Cars, including Safety Appliances.

Mr. Graham Bright, Gen. Engineer, Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., accepted the Chairmanship of the Committee to study Mine Locomotives.

Mr. Fred Norman, Chief Engineer Allegheny River Mining Co., Kittanning, Pa., accepted the Chairmanship of the Committee on Mine Tracks and Signals.

Mr. J. Milliken, Pres. Industrial Car Mfgrs. Institute, 68 Wil-

liam St., New York City, accepted the Chairmanship of the committee on Design and Construction of Coal Mine Cars.

It was later found that the fourth subject, that of Shaft Equipment could be more advantageously handled by the Sub-Committee on Outside Equipment. It was, therefore, dropped from the program of the Committee on Underground Transportation.

On Sept. 8th, 1921, the seventh regular meeting of this Committee was held, a good representation of enthusiastic members and visitors being present. Reports were listened to and discussed, the committee enjoyed a very interesting and beneficial discussion on general subjects pertaining to Standardization.

So far this Committee has met with most hearty cooperation from the operator, the manufacturer and from other Bodies or Societies engaged or interested in this matter of Standardization.

The Committee extends its thanks and appreciation for the assistance and consideration received therefrom. The attached reports submitted by the chairmen of the respective Sub-Committees clearly illustrates the thoroughness and scope of consideration accorded the Subjects.

This entire report is offered as one of progress, and it is earnestly hoped that the work as outlined may be carried forward in the future to the position where its usefulness may become apparent.

Respectfully submitted,

C. E. WATTS, Chairman.
CHARLES M. MEANS,
GRAHAM BRIGHT,
JOSEPH BRYAN,
F. C. COSEO,
D. F. LEPLEY,
E. A. WATTERS,
J. MILLIKEN,
A. H. EHLE,
H. K. PORTER,
FRANK S. BARKS,
FRED NORMAN,
T. A. PARKER.

REPORT OF SUB-COMMITTEE ON MINE LOCOMOTIVES

Mr. Graham Bright, chairman of this sub-committee, advised that while his Committee had been organized and had formulated a program, they had no definite report to offer at this Conference. This Committee, however, will continue this work and hope to have an interesting report to present at our next Conference.

Since the Standardization Conference, Mr. Bright, chairman

of this sub-committee, has taken up this question of Standardization of Mine Locomotives with the Power Club as he thinks they will be vitally interested in this subject. It is expected as soon as the Power Club has had opportunity to consider the matter that a representative committee will then be appointed, and it is hoped to formulate a program and work out definite recommendations in the near future.

REPORT OF SUB-COMMITTEE ON DESIGN AND CONSTRUCTION OF MINE CARS INCLUDING SAFETY APPLIANCES

The report of this Committee for the year must be one of progress only, which is due entirely to the unparallel business conditions of the country. The Chairman of the Committee believes that all standardization work of the American Mining Congress should very largely be in the hands of the mine operators. As it is a fact that any standards that are recommended must be acceptable to the mine operators, it is thought that much time will be saved by establishing their direct interests and responsibilities in the questions at the start. It is felt too that manufacturers should be represented on these committees in order that the operators may receive the benefit of their technical knowledge. The following representatives of coal mine operating companies, car builders, and the Bureau of Mines have accepted service on this Sub-committee.

Company	Representative	Title
Consolidation Coal Co.	R. L. Kingsland	Gen. Supt., P. & M. D.
Hockensmith Wheel & Mine Car Co.	W. K. Hansen	Gen. Supt.
Standard Steel Car Co.	H. M. Estabrook	
American Car & Foundry Co.	A. E. Ostrander	C. E.
Berwind-White Coal Mine Co.	C. E. Watts	M. E.
Bureau of Mines	H. M. Motherwell	M. E.
Westmoreland Coal Co.	C. I. Witmer	M. M.
Industrial Car Mfrs. Inst.	J. Milliken	Pres.; CHAIRMAN

The Committee realizes the necessity of correlating its work with that of the Track Committee and Committee on Locomotive Design. It, therefore, approves those features of the report of the Committee on Underground Transportation submitted to the last meeting of the American Mining Congress, covering gauge of track, track curvature, wheel base, and the relation of the length of cars to the wheel base.

There have been spirited discussions relative to the best means of approaching the possibilities of standardizing parts of coal mine cars. The impracticability of establishing definite standards for cars operated in existing mines was well developed and it has been decided that the best results will be accomplished should this Committee make recommendations for some of the

detailed parts of cars rather than to attempt to make definite recommendations covering such things as car lengths, widths, heights, sizes, etc.

It has been decided that specifications for materials, sizes and types of such items as rivets, bolts, car irons, drawbars, bumpers, couplings, etc., could well be standardized; that recommendations governing the sizes of lumber and sheet steel for car bodies could be given; questions of wheels, sizes and types could well be investigated and definite recommendations made.

As a result of these deliberations, the following committees have been appointed and are now actively at work in order that they may at a later date make definite recommendations that can readily be adopted by the Standardization Division.

1. COMMITTEE ON SIZES AND TYPES OF DRAWBARS, BUMPERS AND COUPLINGS.
2. COMMITTEE ON SIZES OF RIVETS, BOLTS AND IRONS FOR BOTH WOOD, STEEL AND COMPOSITE CAR BODIES.
3. COMMITTEE ON SIZES OF LUMBER AND STEEL SHAPES FOR CAR BODIES.
4. COMMITTEE ON WHEELS, who will present definite recommendations leading to standardized diameters, treads and flanges, with definite recommendations covering the length of wheel hubs together with the relations of the hub to the flange of the wheel for both roller and plain bearings for the most generally used sizes of cars.
5. COMMITTEE ON TYPES OF HAND BRAKES.

CHAIRMEN OF COMMITTEES

R. L. Kingsland, General Superintendent, Consolidation Coal Company, Fairmont, W. Va., was appointed Chairman of the Committee on Sizes of Rivets, Bolts and Irons for both Wood, Steel and Composite Car Bodies.

C. K. Witmer, Master Mechanic, Westmoreland Coal Company, Irwin, Pa., was appointed Chairman of the Committee on Wheels.

H. M. Motherwell, Mechanical Engineer, U. S. Bureau of Mines, Pittsburgh, Pa., was appointed Chairman of the Committee on Types of Hand Brakes.

The desirability of having definite specifications to cover the materials used in the construction of mine cars has been well established and the Committee makes the following definite recommendation, that

Specifications of the American Society for Testing Materials

should be adopted as standards for steel plates, bars, shapes and rivets, for gray iron, malleable iron and steel castings, and for bolts and nuts.

A copy of these specifications is attached as part of this report, including a copy of the American Railway Association's Specifications for Bolts and Nuts, which the Chairman recommends adopting until such time as the American Society for Testing Materials shall have completed a specification.

Respectfully submitted,

J. MILLIKEN,

Chairman, Sub-committee on Design and Construction of Coal Mine Cars including Safety Appliances.

The committee editing the reports, discussions, etc., to be printed in this "Bulletin" decided that the expense and delay by including the three sets of specifications referred to in the above report did not warrant their being printed in this edition of the "Standardization Bulletin." They are all standard specifications which it is presumed most engineers are familiar with in general and the purpose of this "Bulletin" being to elicit discussion and criticism of the reports preparatory to their final revision and adoption it is further assumed that those reading the reports would not wish to pass on the details of these specifications but rather on the advisability of adopting these specifications as recommended by this sub-committee.

Should anyone reading this report wish to obtain the specifications and study them in detail they can be procured from the following sources:

"Standard Specifications for Structural Steel for Cars." Serial Designation; A 11-16.

also

"Standard Specifications for Gray-Iron Castings." Serial Designation; A 48-18.

also

"Standard Specifications for Malleable Castings." Serial Designation; A 47-19.

and

"Standard Specifications for Steel Castings." Serial Designation; A 27-16.

may all be procured from the American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa.

The "Standard Specifications for Bolts and Nuts" referred to in the report of the Sub-Committee may be procured from the American Railway Association, 431 So. Dearborn Street, Chicago, Ill.

Permission having been obtained from the A. S. T. N. and the A. R. A. to use their specifications in this connection we have no doubt they will be very glad to furnish copies of such specifications to those desiring them.

REPORT OF THE SUB-COMMITTEE ON MINE TRACKS AND SIGNALS

PERSONNEL

This sub-committee being appointed at a meeting of your committee at Pittsburgh, Pa., March 15, 1921, with the writer as chairman, and organized by mail with the following members:

Fred Norman, Chief Engr., Allegheny River Mining Co., Kittanning, Pa., Chairman.
I. J. Harvey, Mine Supt., Helvetia, Pa.
John Woodall, Mine Supt., Conifer, Pa.
Arthur White, Mine Supt., Seminole, Pa.
William P. Jones, Mine Supt., Chickasaw, Pa.
Thomas H. Thompson, Mine Inspector, Kittanning, Pa.
W. P. Buckwalter, Manufacturers' Agent, Pittsburgh, Pa.
Charles H. Partington, Chief Engr., Cincinnati Frog and Switch Co., Cincinnati, O.
T. H. Edelblute, Manufacturers' Agent, Pittsburgh, Pa.
J. K. Lansdowne, V. P., Weir Frog Co., Cincinnati, O.
F. W. Holcomb, Weir Frog Co., Cincinnati, O.
A. S. Carr, Manufacturers' Agent, Pittsburgh, Pa.
W. H. Rubbe, Chief Engr., American Frog and Switch Co., Hamilton, O.

HISTORY

Considerable correspondence was carried on between the members and chairman, with a meeting in Pittsburgh, Pa., July 19th, 1921, for a general discussion of the subjects before the committee.

Five members of the sub-committee meeting with your committee on Underground Transportation at call of Chairman, September 7th, at Pittsburgh, Pa.

Track Gauge—The Committee generally concurred in and agreed with the recommendations submitted by your Committee at Denver to adopt 42" gauge as standard mine track gauge, and our findings are based on this recommendation. From your report at Denver we learn that about 80% of the gauges in use in the U. S. A. are 42", which is corroborated by our records.

One concern building electrical mine locomotives found 54%-42" gauge, while one of the Frog and Switch Manufacturers found 37% of their product calling for 42" gauge. This is exceptional as switch material was sold to many small mines that sprung up during the war, and as a rule adopted narrow gauges for working crop coal under shallow cover, etc., and lessened the percentage of wider gauges temporarily.

The committee, with one or two exceptions, favored 42"; the exceptions, 36" gauge.

Turnouts—At our July meeting in Pittsburgh your committee concentrated on Turnouts and Switches. The matter of phrase-

ology in designating switch material was discussed, and for the benefit of all concerned in ordering switch material to use a "standard" designation, as follows:

ONE COMPLETE TURNOUT consists of 1 frog, 2 filler rails, 2 switchpoints with bridle or bridles, and slide plates, and 1 switch stand with connecting rod.

ONE COMPLETE SWITCH consists of 2 switchpoints with bridle or bridles and slide plates, and 1 switch stand with connecting rod.

If not all of the material is wanted it can be stated as: One complete turnout without filler rails, etc., or, One complete switch without switch stand, etc.

Curvature—In connection with turnouts we concur also in your Committee's recommendation of a minimum curve of 28′ (thio) radius corresponding to a No. 2 turnout for entering rooms from entry.

For turnouts between room entries and face or panel entries a No. 3 turnout with 63′ (thio) radius, and between face or panel entries and Main haulage entries, a No. 4 turnout with 112′ (thio) radius, giving ample variety to suit the majority of inside conditions. With this in view, the Frog and Switch manufacturers represented on the committee have worked out detail plans of Nos. 2, 3 and 4 turnouts. Covering rail sections from 16 to 60 pounds.

Room Turnouts—It will be noted that the No. 2 turnout consists of 1 No. 2 frog, 2 filler rails, and 1 3′ 0″ or 3′ 6″ split switch with one bridle and four sliding plates. Switch stand not shown on drawing. In many cases switch stands are not used, the switch simply being kicked into position, and the friction of the bridle holding it in place. However, with gathering locomotives a switch stand is desirable.

This Committee favors the No. 2 turnout for rooms, with the only objection that the longer radius curve requires a wider room neck, which is sometimes impracticable in tender roof. In such cases, the rooms can be turned off the entry at an angle of 45° and at a predetermined distance turned an additional 45° to get the room at right angles to the entry, or any other angle desired. This will eliminate any widening of the room neck, besides materially easing the curvature into the room. A drawing showing this arrangement is incorporated with the turnouts submitted. See Figs. 1 to 5 incl. for No. 2 turnout, and Fig. 18 for the "room neck diagram."

No. 3 Turnout—Several drawings of No. 3 turnout, with No. 3 frog and 6′ 0″ split switch with one bridle and four sliding plates covering from 16 to 35 pound rail for fishplate connections, and from 25 to 45 pound rail for angle-bar connections. See Figs. 6 to 12 incl. for No. 3 turnout.

No. 4 Turnout– The drawings covering No. 4 turnouts show

No. 4 frog with 6″ split switch having 2 bridles and 6 sliding plates, for 40 and 45 pound, and 50 to 60 pound rail sections. See Figs. 13 to 17 incl. for No. 4 turnout.

It is this Committee's opinion that these three turnouts, Nos. 2, 3 and 4, will cover most conditions met with in coal mines, and recommend their adoption as standards in connection with a 42″ gauge of track.

Switch Stands—The matter of switch stands to operate the switches has not yet received the consideration it should have. The consensus of opinion is on "Parallel Throw," but as to the "Upright Lever" or "Ground Lever," the opinions are divided. This Committee therefore is unable to make a recommendation on this subject at present.

Switch Ties and Cross Ties—Sets of switch ties can be worked out for each particular turnout, but as this matter has not yet been considered, have no recommendations to make.

Roadbed, Headings, etc.—The width of entries and the position of the track, etc., varies much in practice. Usually the track is not in the center, but a little to one side of the center line in order to allow for ditching and passageway for men.

Signals—This subject has been discussed to some extent. The Committee agrees that some kind of "Black Signal" system should be introduced in all mines operated with power haulage, but the subject has not yet reached a stage where recommendations can be made.

General—This Committee has concentrated its efforts on turnouts for the present, considering this the first and most important step toward standardization, next to a standard track gauge.

The Committee members have shown real enthusiasm, and the chairman feels that he is under heavy obligations for the valued assistance rendered, especially so to the representatives of the Weir Frog and Switch Company and the Cincinnati Frog and Switch Company, both of Cincinnati, Ohio, who have worked out and prepared the plans and drawings herewith submitted; also to the American Frog and Switch Company, Hamilton, Ohio, and the Ironton Engine Company, Ironton, Ohio, for their able and valuable assistance.

Respectfully submitted.

FRED NORMAN,
Chairman, Sub-committee on
Mine Tracks and Signals.

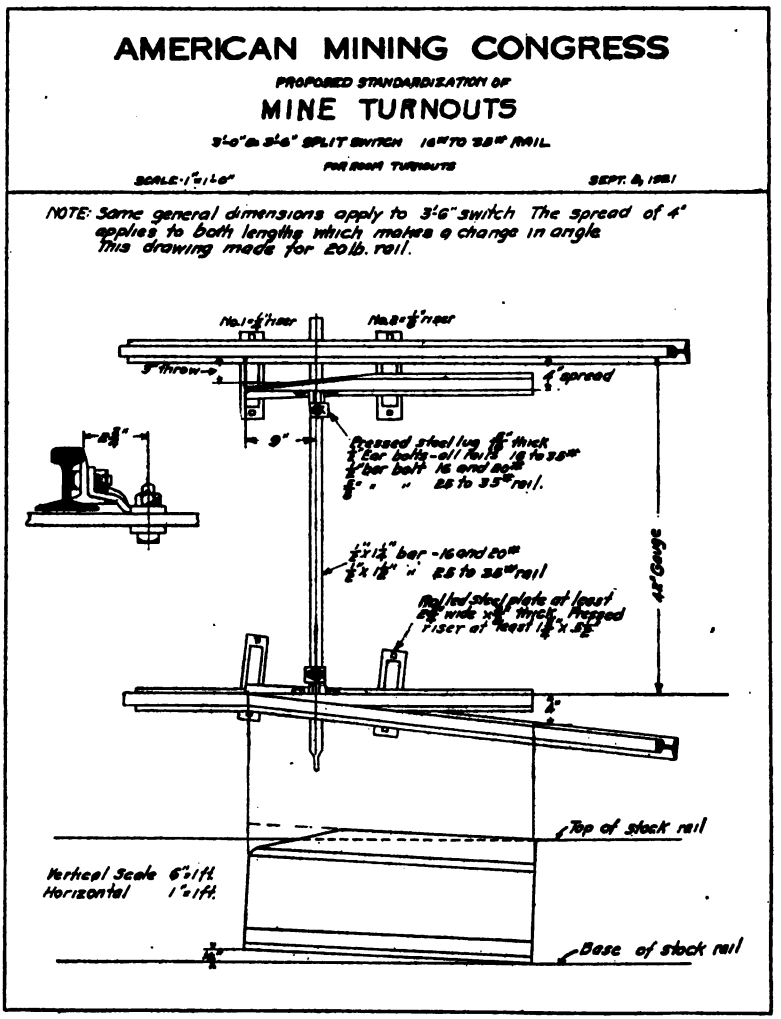

AMERICAN MINING CONGRESS
PROPOSED STANDARDIZATION OF
MINE TURNOUTS
3'-0" & 3'-6" SPLIT SWITCH 16# TO 35# RAIL
FOR ROOM TURNOUTS
SCALE: 1"=1'-0"
SEPT. 4, 1931
NOTE: Same general dimensions apply to 3'-6" switch. The spread of 4" applies to both lengths which makes a change in angle. This drawing made for 20 lb. rail.
No.1 riser
No.2 riser
3" throw
4" spread
2 1/4"
3"
Pressed steel lug 1/4" thick
2 bar bolts - all rails 16 to 35#
1 bar bolt 16 and 20#
1/2" " " 25 to 35# rail.
1"x1 1/2" bar - 16 and 20#
1/2"x1 1/2" " 25 to 35# rail
Rolled steel plate at least 2 1/2" wide x 1/4" thick. Forged riser at least 1/2"x 2 1/2"
4'-0" Gauge
1/2"
Top of stock rail
Vertical Scale 6"=1 ft.
Horizontal 1"=1 ft.
Base of stock rail

Fig. 1—No. 2 Turnout.

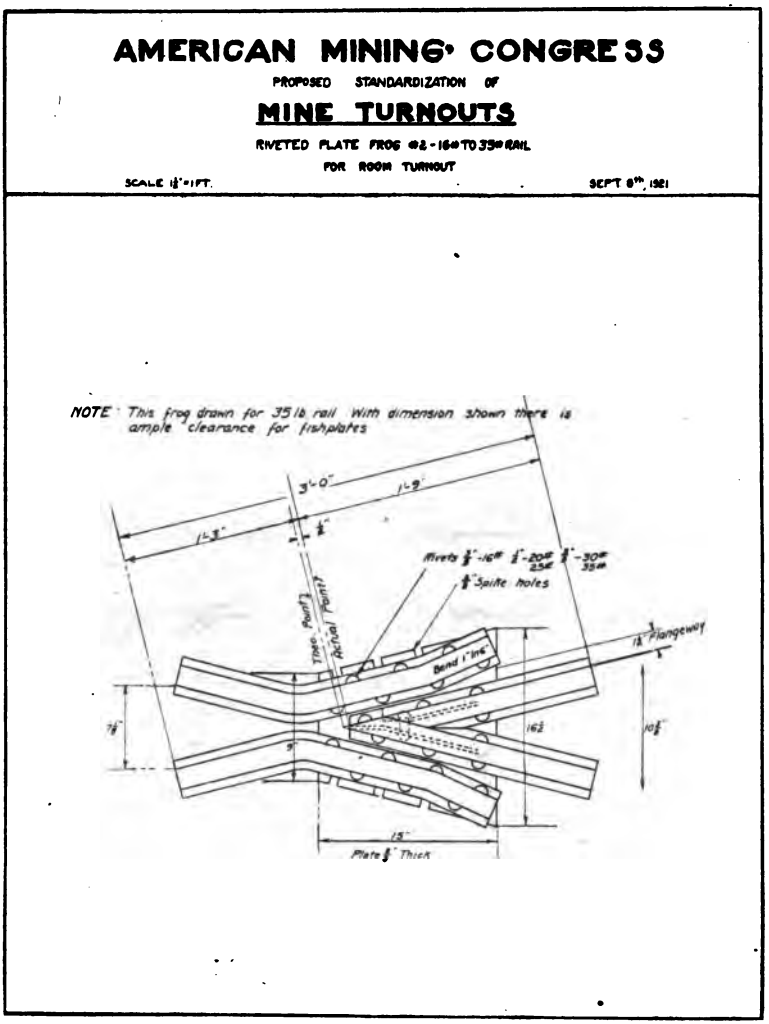


Fig. 2—No. 2 Turnout.

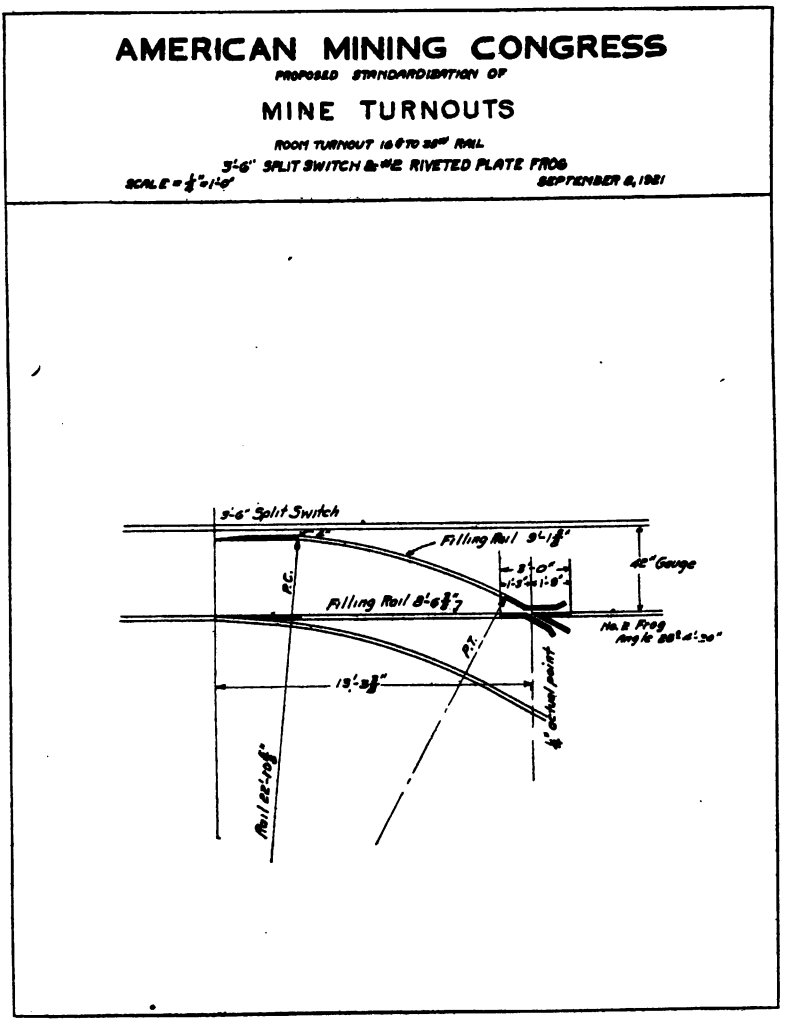


Fig. 3—No. 2 Turnout.

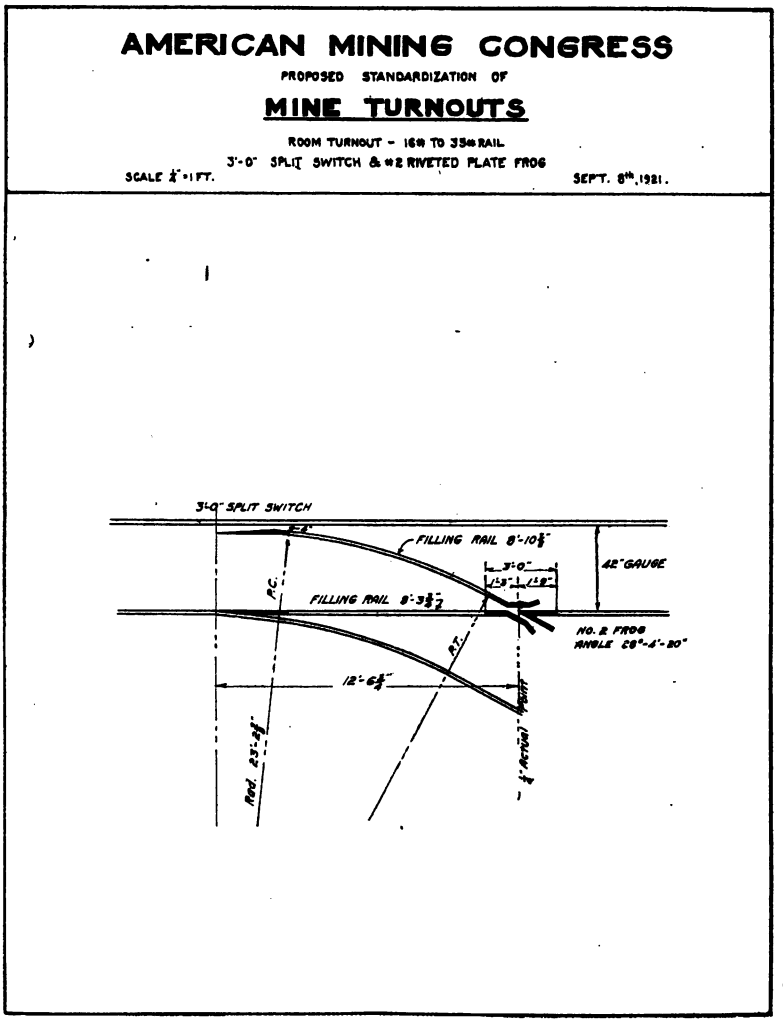


Fig. 4—No. 2 Turnout.

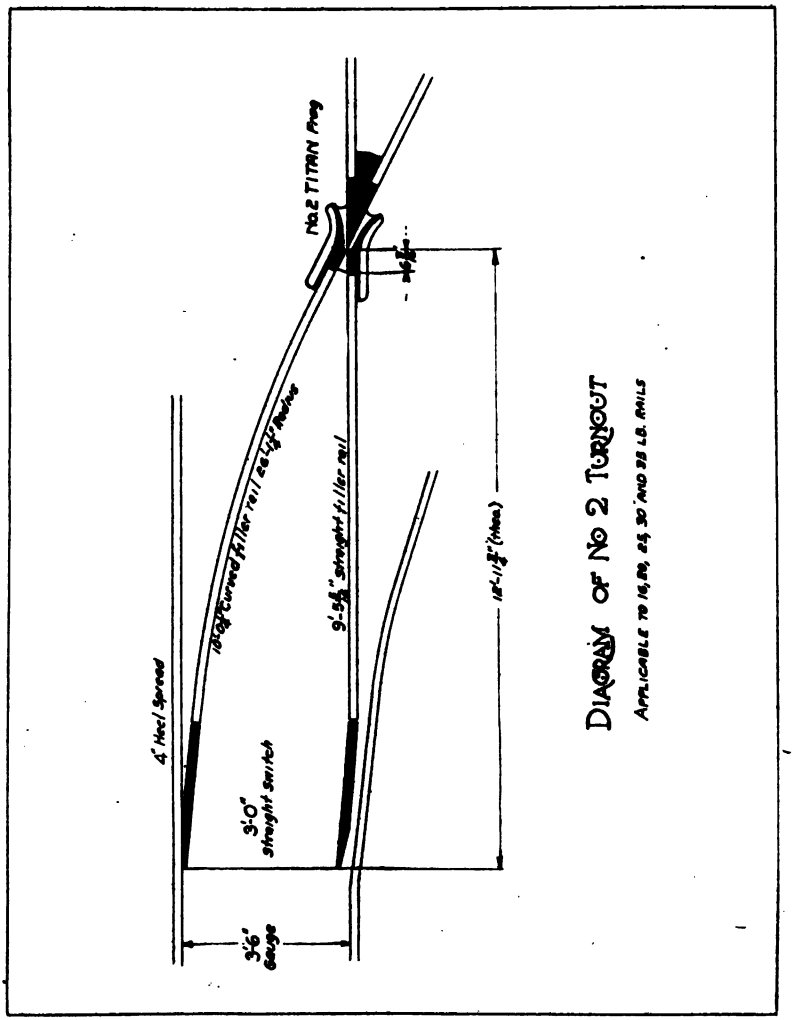


Fig. 5—No. 2 Turnout.

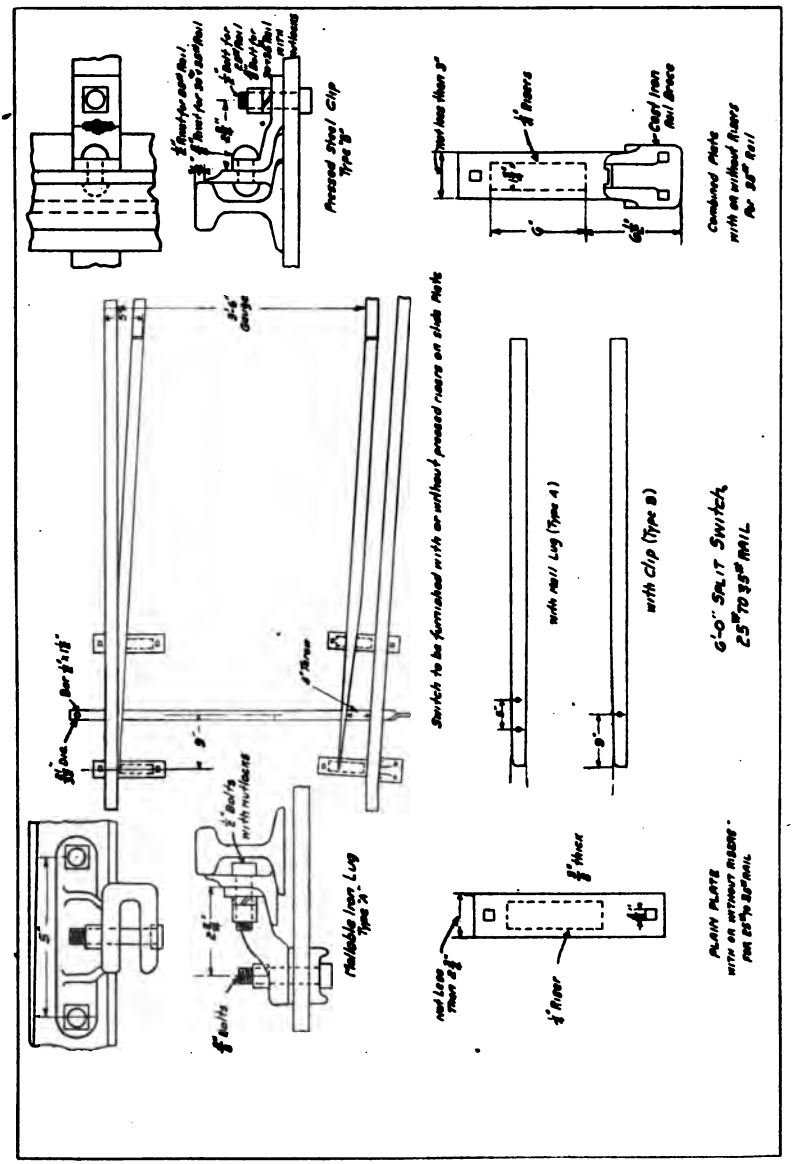

Pressed Steel Clip
Type "B"
Switch to be furnished with or without pressed risers on slide Plate
with rail Lug (Type A)
with Clip (Type B)
6'-0" Split Switch
25 lbs to 35 lbs Rail
Reversible Iron Lug
Type "A"
Cast Iron Rail Brace
Combined Plate
with or without Risers
for 25 lbs Rail
PLAIN PLATE
WITH OR WITHOUT RISERS
FOR 25 lbs TO 35 lbs RAIL

Fig. 6—No. 3 Turnout.

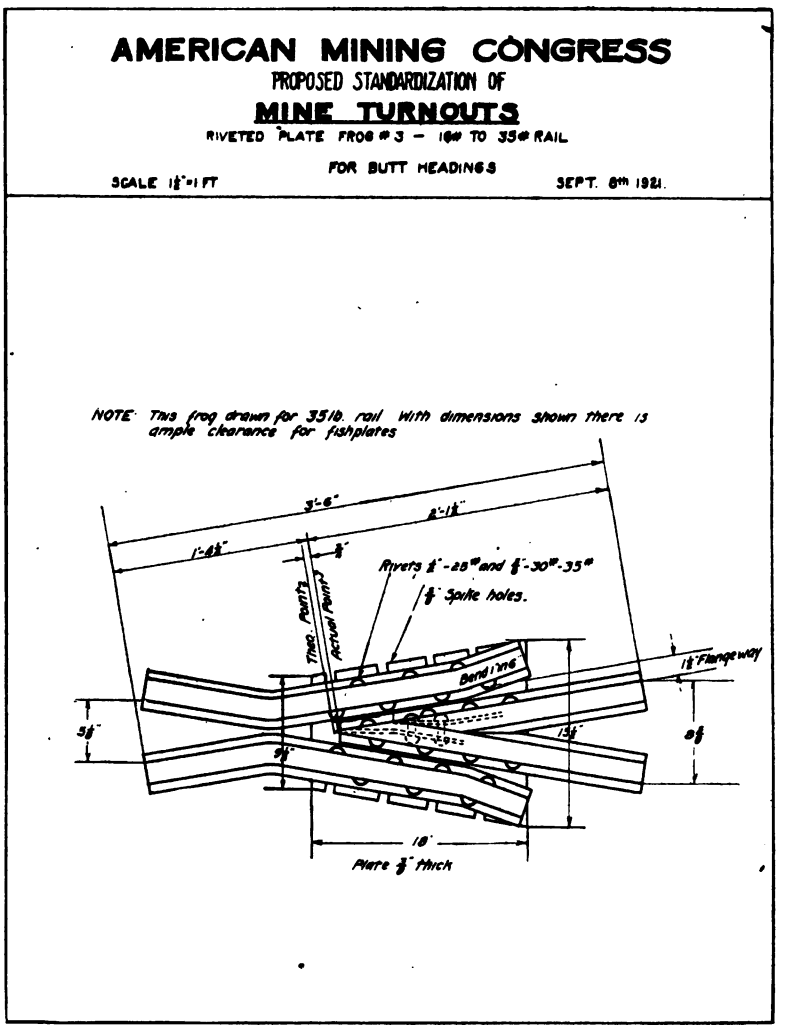


Fig. 7—No. 3 Turnout.

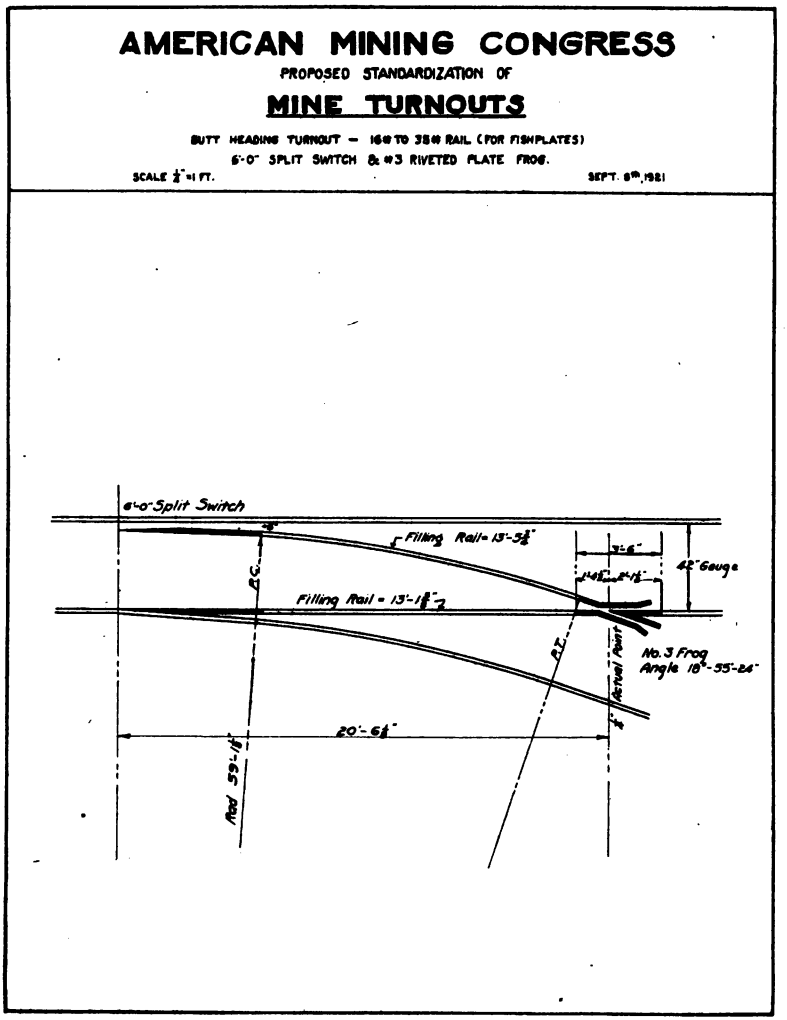


Fig. 8—No. 3 Turnout.

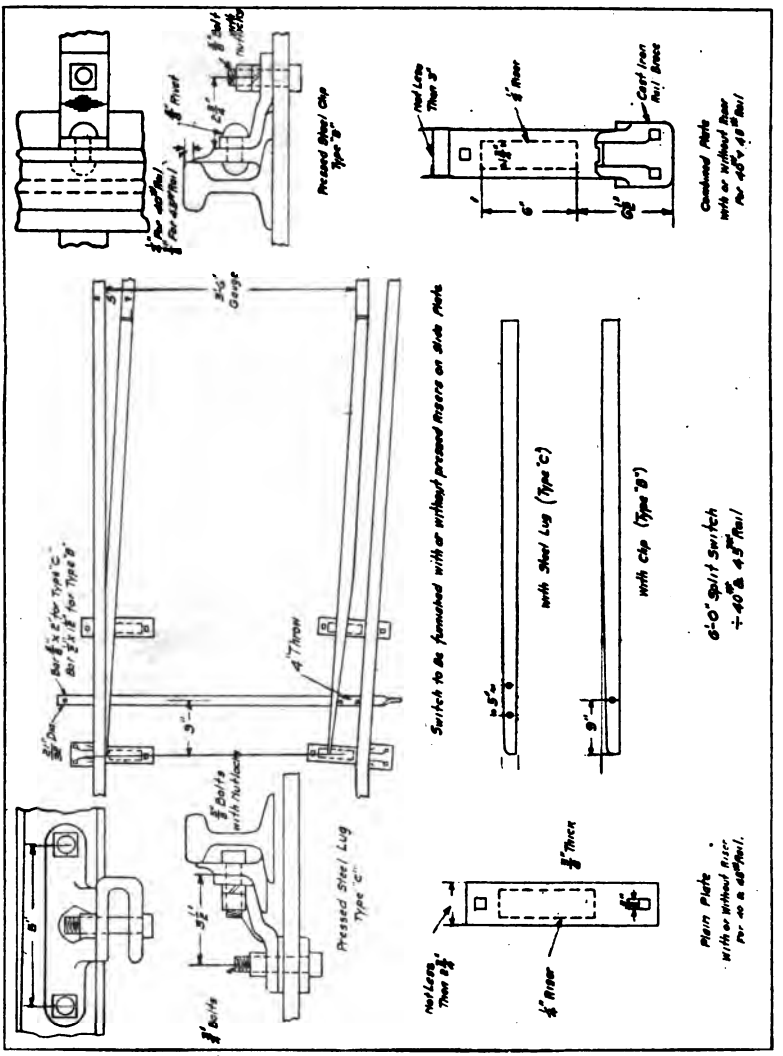


Fig. 9—No. 3 Turnout.

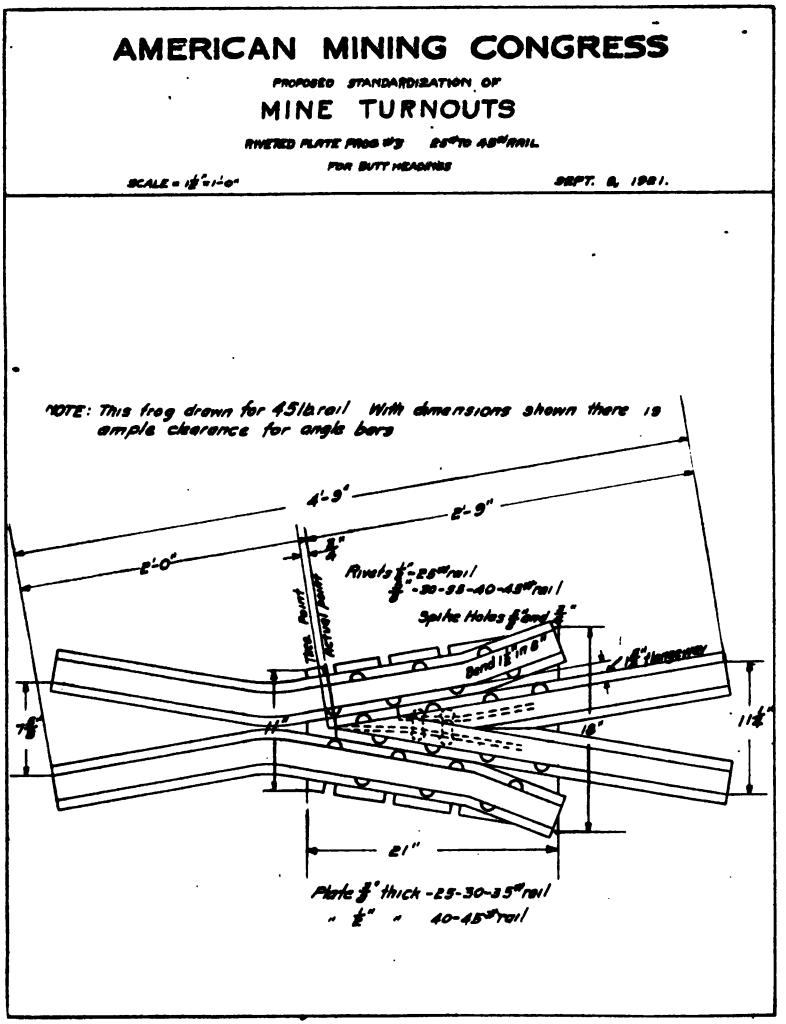


Fig. 10—No. 3 Turnout.

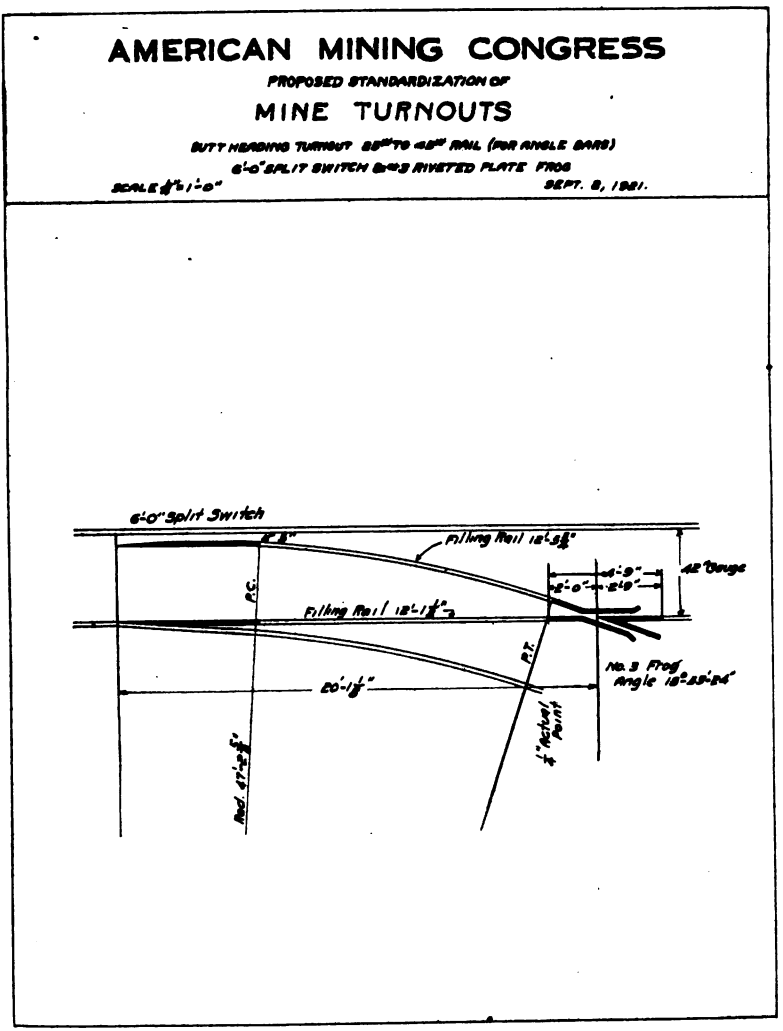


Fig. 11—No. 3 Turnout.

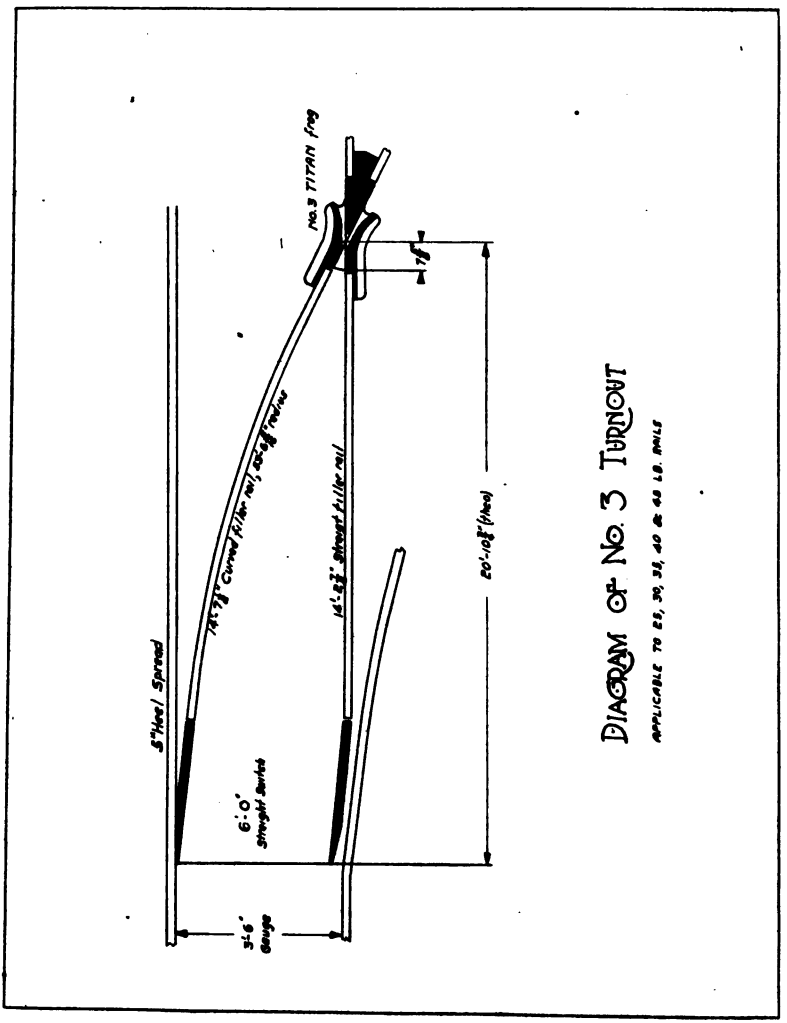


Fig 12—No. 3 Turnout.

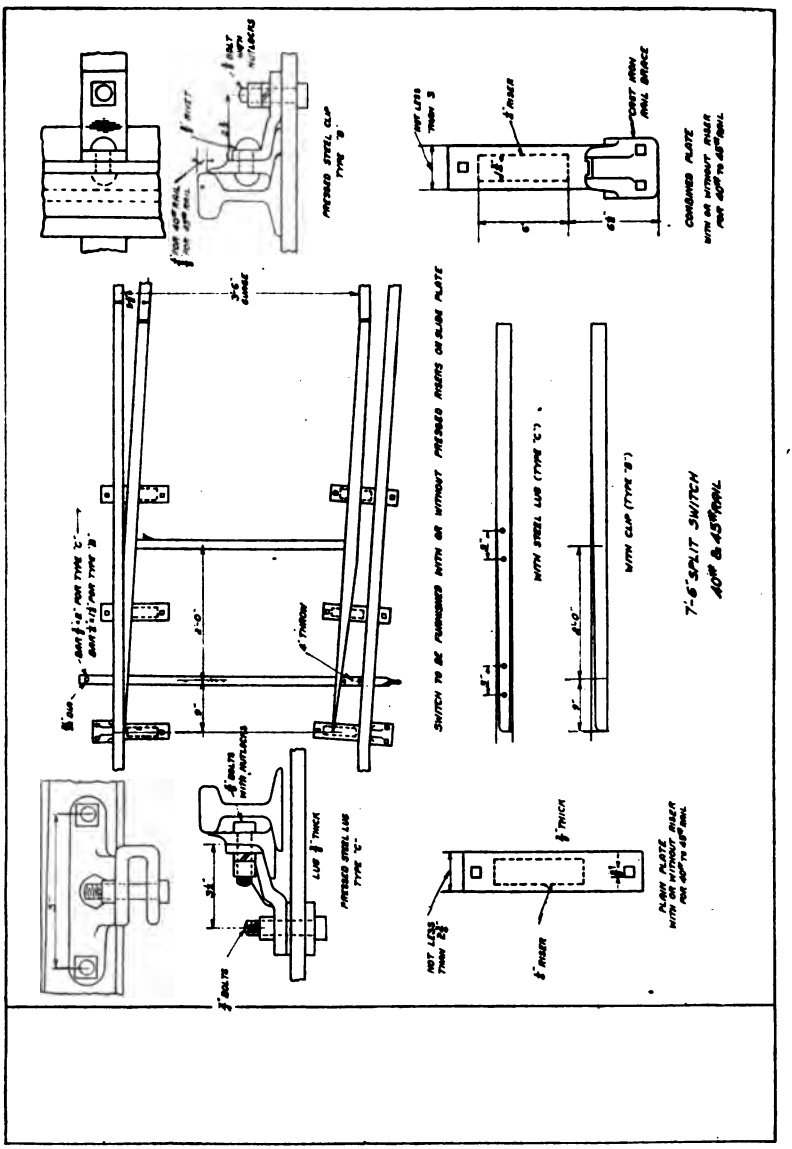

7'-6" SPLIT SWITCH
40# & 45# RAIL
SWITCH TO BE FURNISHED WITH OR WITHOUT PRESSED RISERS OR SLIDE PLATE
WITH STEEL LUG (TYPE "C")
WITH CLIP (TYPE "B")
PRESSED STEEL CLIP TYPE "B"
PRESSED STEEL LUG TYPE "C"
CAST IRON RAIL BRACE
COMBINED PLATE
SLIDE PLATE
4'-0"
6" THROW

Fig. 13—No. 4 Turnout.

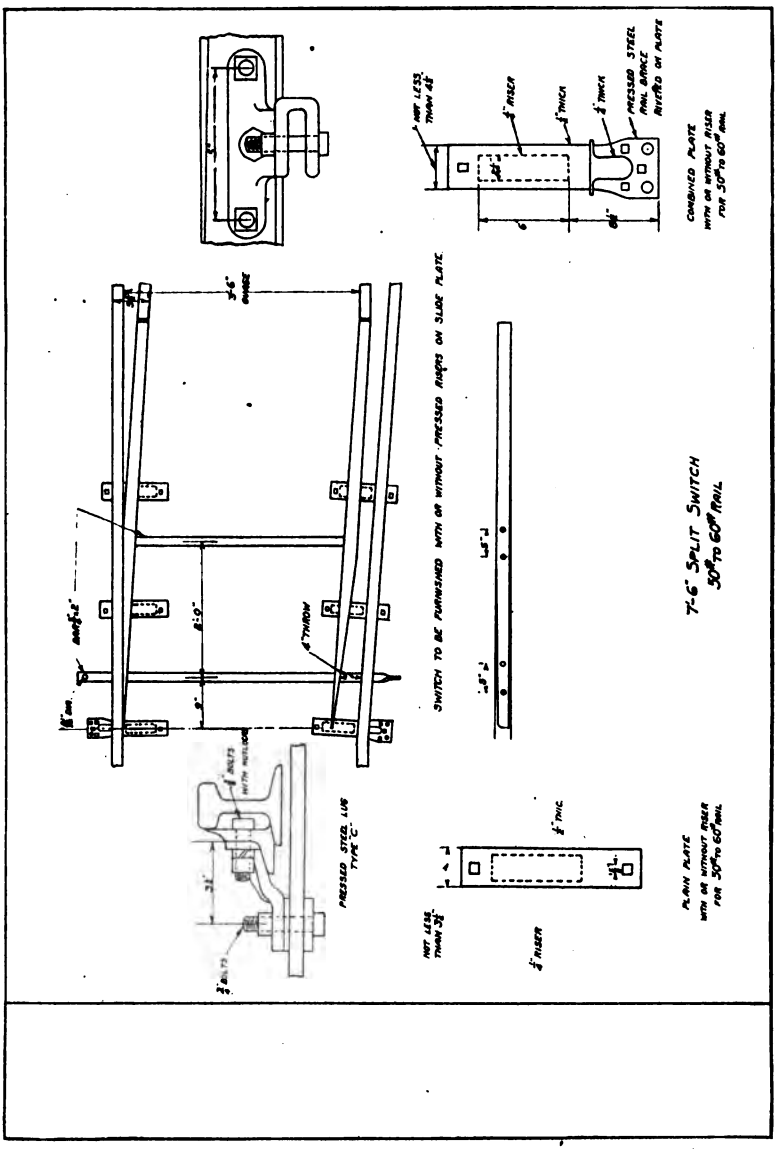

7'-6" Split Switch
30# to 60# RAIL
SWITCH TO BE FURNISHED WITH OR WITHOUT PRESSED RISERS ON SLIDE PLATE
PRESSED STEEL TIE TYPE "C"
COMBINED PLATE
PLAIN PLATE
PRESSED STEEL RAIL BRACE

Fig. 14—No. 4 Turnout.

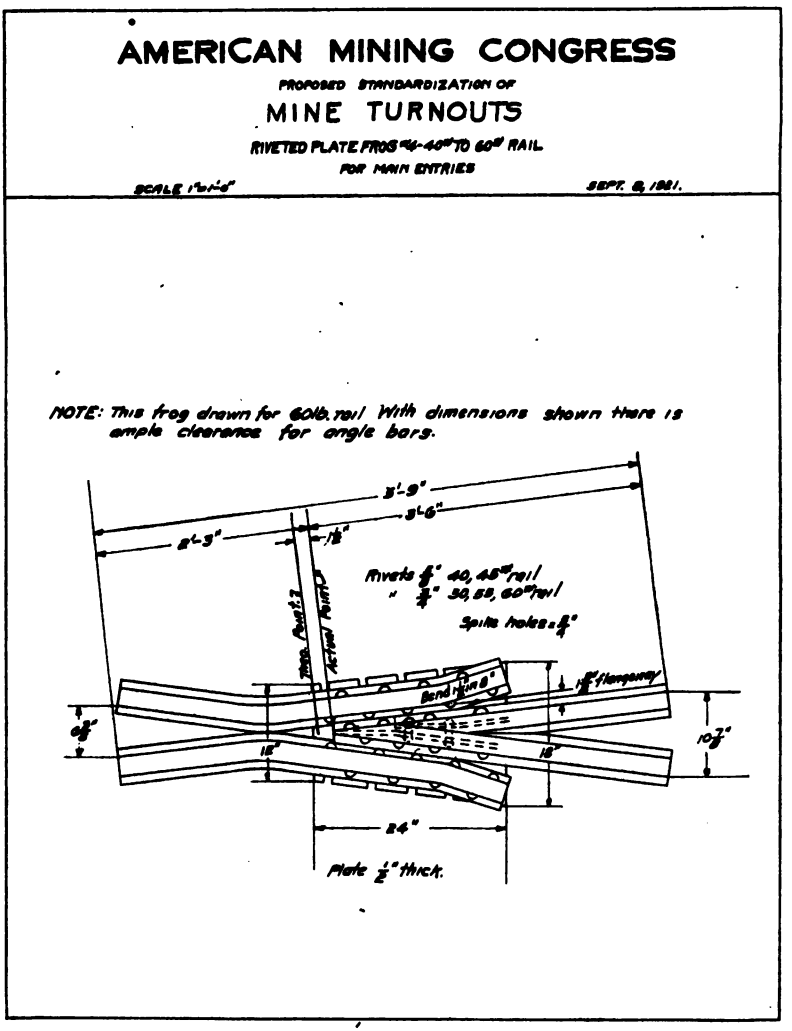


Fig. 15—No. 4 Turnout.

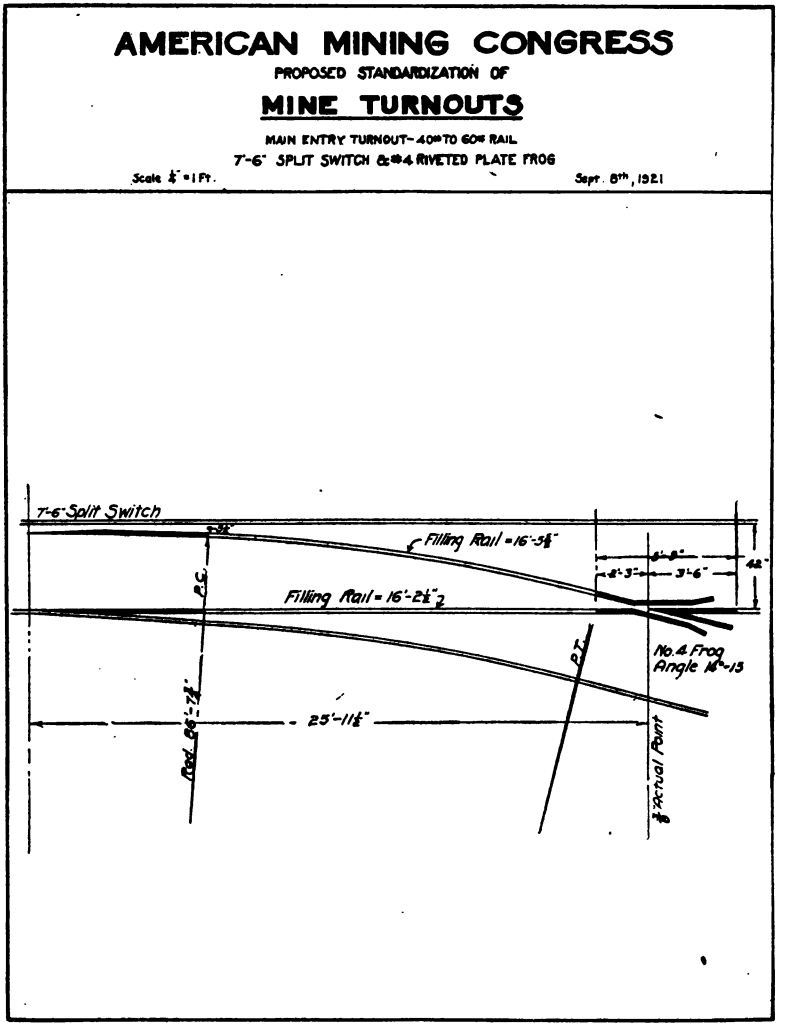


Fig. 16—No. 4 Turnout.

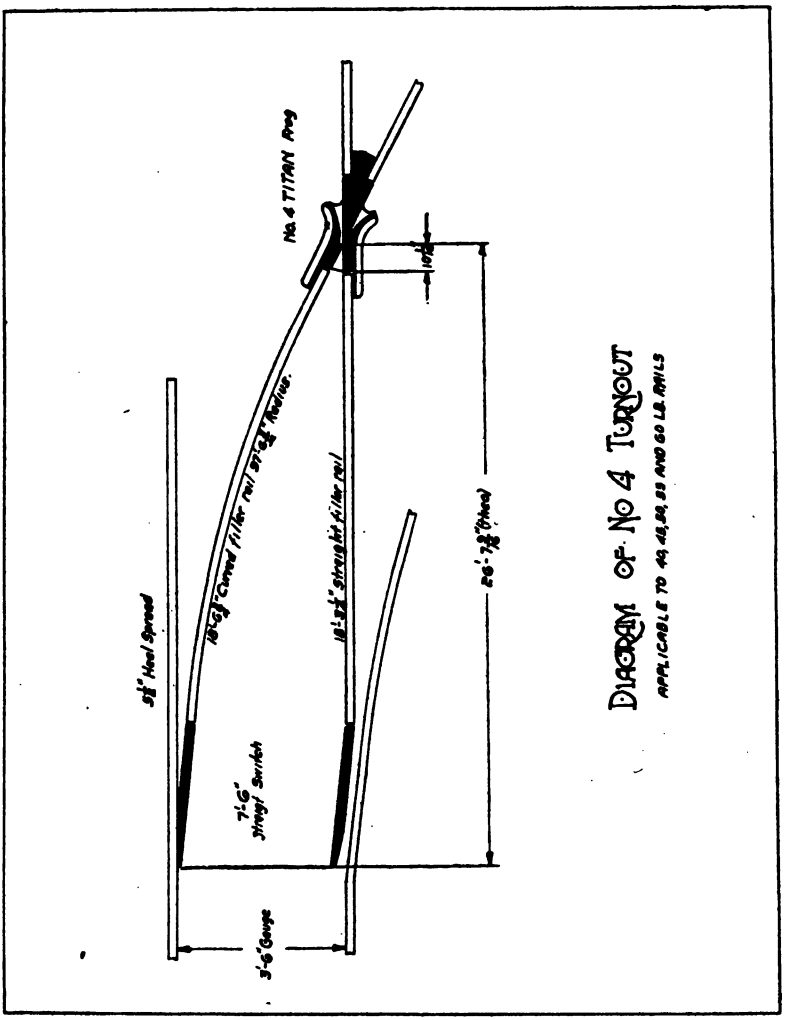


Fig. 17—No. 4 Turnout.

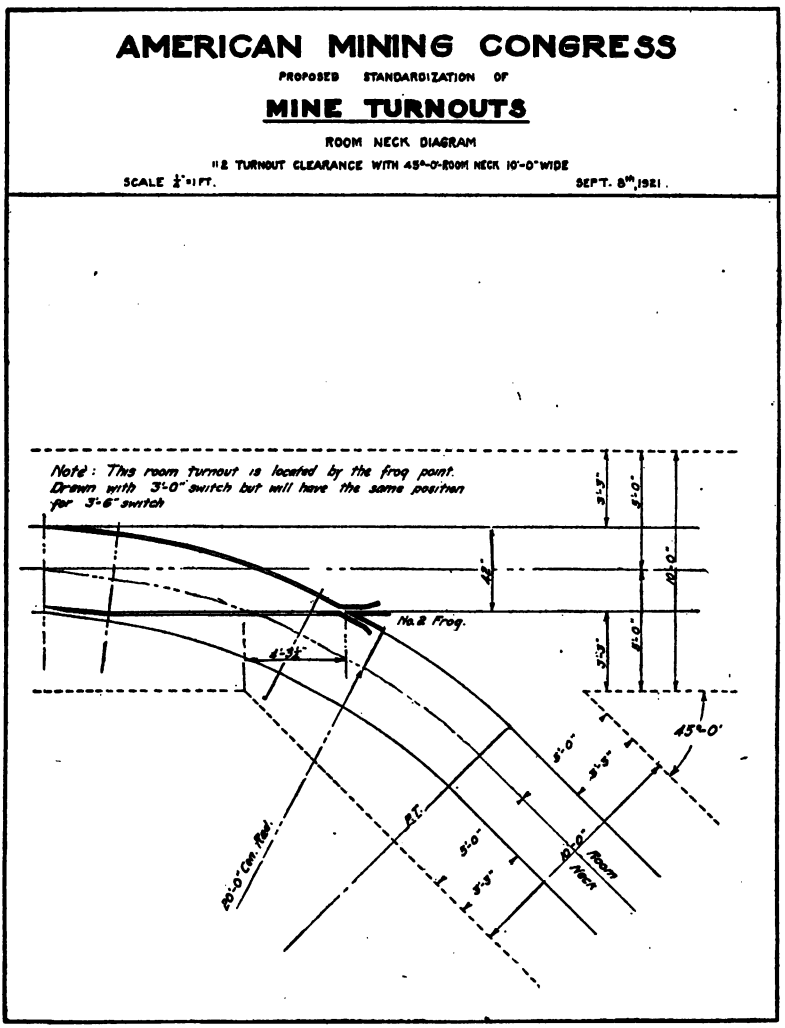


Fig. 18—Room Neck Diagram.

COL. MILLIKEN: Gentlemen, you have heard this report. Mr. Bright's report is simply one of progress, and the only thing that can be done is to accept it as such. You have heard a synopsis of the report of the Committee on Mine Tracks and Signals, and I believe it would be well to have a discussion at the present time on that feature of the report. Possibly Mr. Norman, who is here, will have something to say in addition to what I have read.

MR. NORMAN: I haven't anything to add unless somebody asks some questions.

MR. R. I. WERT: In the standardizing of the gauge and making it 42 inches, I think we ought to take into consideration the size of the vein of coal. While now the thicker veins are being worked, some of the smaller ones are also being worked and as time goes on there will be more of the smaller veins being worked. It is a pretty expensive undertaking to get a 42-inch gauge and leave any drainage ditch on the side.

I realize that a man can haul more coal on a 42-inch gauge track, but with the smaller seams in a great many instances it would not be practical to use the large car bodies, especially where it is a push proposition. Before anything definite is adopted, I think that point should be taken up. In other words, it might be of more advantage to the industry in general if we had two gauges, one for the larger seam and one for the thinner.

MR. NORMAN: You mean two standards?

MR. WERT: Yes.

ACTING CHAIRMAN MILLIKEN: That was considered very carefully, I know, by the Track Committee. I happened to be present at some of their meetings, and as it was brought out in the reports, statistics show that 80 per cent of the tracks that are now being installed in mines are 42-inch gauge. Undoubtedly there will have to be some exceptions to any standards or recommended practices that the Mining Congress may make; but it was the thought of this Committee that they should recommend what is considered the best and most economical track systems for mine operations.

MR. NORMAN: You understand that the 42-inch gauge had been recommended last year at the Denver convention and that the present Committee based their findings on that standard already adopted.

MR. CARL LEE: I think it was discussed at one of the first meetings of the Standardization Committee and that it was practically decided a 42-inch gauge was proper, with the alternative of 6-inch variations over or under for special conditions where they have to get down to 30 and 36-inch gauge, and possibly up to 48-inch gauge.

MR. EDE: I thing that should also apply to long wall work. That is a very large gauge to put in long wall work.

MR. NORMAN: Would it not be optional to have any gauge you would want, even if there was one standard gauge, the same as with a standard gauge railroad?

MR. EDE: Yes.

MR. NORMAN: Inasmuch as 80 per cent of the people use a 42-inch gauge and that is the standard gauge, all other gauges would be special. As it is now they are all special.

MR. EDWARDS: In this discussion I have been thinking of the situation that exists with the company with which I am associated. At present they have 36-inch, 40-inch, 42-inch, 44-inch and 48-inch gauge, and the conditions are the same in all of those mines. The fact was that they purchased mines in which this equipment had already been installed. There is so much equipment that it is practically out of the question to change. However, if when that was installed there had been some standard, such as 42-inch gauge, perhaps all of those would have been 42.

So I think there should be a recommendation for 42 as standard and everything else could be special.

ACTING CHAIRMAN MILLIKEN: I think that was very largely the thought that governed the Committee in making their recommendations. There are all kinds of gauges at the present time, even down to half inches. That is the thing we really want to eliminate, and emphasize the desirability of one gauge of track.

MR. EDE: I think that is absolutely correct for it would save a great deal of expense and enable interchange, which is impossible now. The other day we had an experience with a mine in which there were two different gauges. There is no reason why they should not have been the same. Quite a number of the mines in the northern field have different gauges. I think if there was a standard made for the long wall, as well as for the pillar, it would be beneficial.

ACTING CHAIRMAN MILLIKEN: I am very sure the Committee will give your thought consideration.

MR. KNIGHT: I believe the point that these gentlemen are driving at is simply this: it is simply a repetition of the same point, just as Mr. Edwards has brought out on the 42-inch gauge—in other words, if we set a standard of 42 inches, where that is possible, it would clear up the possibility of having a number of different gauges.

On the other hand, suppose that is the sole recommendation, then we will say that where 42 is not possible, it might be you could use 36 or 24 or 38 or 40, or any other gauge. I think that what these gentlemen are driving at is that there ought to be some definite recommendation, where 42 is not possible, so that under other conditions, you would have a recommendation of a gauge that could be used. Then you should stick to that and not have a number of other gauges where you would be in the position mentioned by Mr. Edwards.

MR. S. W. FARNHAM: From the manufacturers' viewpoint, I can certainly testify to the expense and difficulty of furnishing locomotives for all sorts of gauges. We have had 33 inches, 31 inches, or any odd size that occurred to the man who opened the mine. That was during the time when odd gauges were prevalent.

I agree with Mr. Knight's point, that if you recommend a 42-inch gauge as a standard, which is an excellent standard, I think, and say nothing more, that leaves a man with special conditions free in his own mind to select anything that he might choose. If, on the other hand, you suggested that where the conditions do not permit the use of the recommended standard of 42 inches that he try to select some one of the 6-inch divisions, as pointed out by Mr. Lee—namely, 24 or 30 or 36 or 48—then that will at least reduce the number of possible variations in future operations.

ACTING CHAIRMAN MILLIKEN: Those thoughts, gentlemen, will all be considered by the Joint Committee of the two branches and some definite recommendations will be made later on.

If there are no further remarks on the subject of Tracks, we will go to the question of Car Construction. The definite recommendation there by the Committee is the adoption of specifications for materials, and they have recommended the A. S. T. M. specifications (that is the American Society for Testing Materials) because they are so generally used in not only all car construction but in all metal construction.

The specifications are very clearly written. They are understood by the manufacturers as well as by the buyers, and the Committee is really desirous, if possible, that that recommendation go definitely before the Mining Congress.

I will be very glad to hear any discussion that there is on the report.

MR. O. J. KEYES: I would like to ask if the Committee who has charge of the specifications on wheels and bearings is going to make a definite recommendation as to the wheelbase of a pit car as regards the length. You will find that most of us have had that experience, especially where you have got two or three lots of pit cars in one mine, that there is a different wheelbase quite often.

I believe that the Committee should give their opinion in a case, for instance, where a pit car has a total length of 120 inches, as to what the wheelbase of that particular car should be. I think that would be a valuable thing.

ACTING CHAIRMAN MILLIKEN: There is a Committee that is now giving that subject consideration.

If there is no further discussion, this report will be referred to the Joint Committee and taken up later on.

Unless some gentleman here has something further to bring up, we will declare this meeting adjourned.

Thereupon the meeting adjourned at 5:20 p. m.

COAL MINING BRANCH

Tuesday, October 18, 1921, 2:30 P. M.

The meeting convened at 2:45 p. m., Colonel Warren R. Roberts presiding.

CHAIRMAN ROBERTS: Since Mr. Pauly, the Chairman of our Committee on Power Equipment, and his Committee have not arrived, I want to refer back to some of the uncompleted business of yesterday. You will remember that we appointed a Joint Special Committee representing both the Metal and Coal Mining Branches to receive and coordinate all reports. While we are waiting for Mr. Pauly, we will ask for a progress report by that Committee. Our representatives were Colonel Milliken and Mr. Knight, and the Metal representatives were Mr. Daly and Mr. Notman. Colonel Milliken will report.

COLONEL MILLIKEN: Mr. Chairman, I have a report here and just as soon as I can get the other two members to sign it, we will be able to dispose of it finally.

CHAIRMAN ROBERTS: Very well. We will take up another report. I would like to inquire whether our Committee on Resolutions has received any resolutions from any members of the Conference.

MR. KUDLICH: We have not received any resolutions up to the present time.

COLONEL ROBERTS: We have three other committees to hear from and Mr. Pauly, Chairman of the Committee on Power Equipment is with us, and while he has no report, I would like very much to have him make a verbal statement to you as to the status of his work. It has been referred to, Mr. Pauly, briefly in my general report, but I think you should make a statement with reference to the work.

MR. PAULY: Last year we met jointly with the Committee on Power Transmission and took as a basis for our work the technical paper number one hundred thirty-eight of the Bureau of Mines and attempted to bring that up to date. That done, it seemed to us best to defer further action on our part until such time as that report could be printed and circulated broadcast among as many of the mining engineers as possible, and upon whatever criticisms or suggestions were offered by them to take further action.

Note: The following is last year's report mentioned by Mr. Pauly, which it was thought best should be inserted in this Bulletin.

JOINT REPORT OF COMMITTEES ON UNDER-GROUND POWER TRANSMISSION AND POWER EQUIPMENT

In considering the problem of standardization, we have divided it into two parts: the standardization of equipment, and the standardization of practice in the installation and operation of equipment.

As the Electric Power Club has for its object the standardization of the capacities, voltages, speeds and essential mechanical features of electric motors, generators, transformers, etc., and as its standards are the accepted standards throughout the country, it was suggested that we adopt them as our standards of equipment. It was also suggested that the Standardization

Rules of the A. I. E. E. be adopted as our standards of technical matters.

With the standardization of equipment disposed of we devoted our time and attention to the standardization of practice. This field has been very thoroughly covered by the Bureau of Mines in its technical paper No. 138, entitled, "Suggested Rules for Installing and Using Electrical Equipment in Bituminous Coal Mines," and these were taken as the basis of our work. Each rule was thoroughly discussed and revised where it seemed advisable to do so for the purpose of clarifying it or of making it conform to present day practice.

We, therefore, submit the following as the joint recommendations of the Sub-committees on Underground Power Transmission and on Power Equipment.

That the standards of the Electric Power Club be adopted to our standards of electrical equipment:

That the Standardization Rules of the A. I. E. E. be adopted as our technical standards;

That the following rules be adopted as our standards of practice in the installation and operation of transmission and power equipment.

BASIS OF THE RULES

Five basic measures for safeguarding the use of electricity in mines are as follows:

1. Remove the contributory causes of accidents or danger.
2. Remove from the vicinity of electrical apparatus all elements susceptible to the influence of electricity.
3. Keep the electric current where it belongs, if possible. If not, limit the area of its activity by protective devices.
4. Use a large factor of safety in the selection, installation, and inspection of equipment.
5. Have full control of the movements of electrically driven machines.

Each rule that is given in this report is proposed as necessary or helpful to the accomplishment of one or more of these measures.

DEFINITIONS OF TERMS USED

The meanings of some of the terms and expressions as used in this report are defined below in order to avoid confusion.

ALIVE. See definition of "live."

APPROVED. The term "approved" means accepted as suitable by a competent committee, board, or organization designated by those adopting the rules.

AUTHORIZED PERSON. The term "authorized person" means a person appointed or permitted by the official designated by the State mining laws as the one in charge of the operation of the mine to carry out certain duties incident to the generation, transformation, and distribution or use of electric energy in the mine, such person being one who is competent within the purpose of the rule in which the term is used.

ELECTRIC SYSTEM. The term "electric system" means all electric apparatus pertaining to the operation of the mine and under the control of the mine officials that is connected electrically to a common source of voltage or that is installed so that it can be thus connected.

GROUNDED CIRCUIT. The term "grounded circuit" means a circuit that is permanently grounded at one or more points.

GROUNDING. The term "grounding," as applied to any object used in connection with a permanently grounded electric system means connecting such object to the earth in such a way that a path of low resistance is provided between the object and the permanently grounded point of the system. A connection to a thoroughly bonded rail is an example of a good ground connection.

The term "grounding," as applied to any object used in connection with an electric system that is not provided with a permanent ground means making a connection to the general mass of earth in such a manner as will insure at all times an immediate discharge of electrical energy without danger.

GROUND RETURN. The term "ground return" means that part of a circuit which is the earth, or metallic conductors intimately associated with the earth, and which is practically at earth potential at all points.

LIVE. The word "live" means electrically connected to a source of voltage difference or electrically charged so as to have a voltage different from that of the earth.

PERMISSIBLE EQUIPMENT. "Permissible equipment" refers to any equipment that is listed with the U. S. Bureau of Mines as permissible for use in such places as containing gas or coal dust in explosive mixtures.

PORTABLE ELECTRIC LAMPS. Portable electric lamps are electric lamps that while lighted may be carried about. This general term includes lamps operated by batteries and lamps connected to a source of power by a flexible conductor whose length limits the range over which the lamp may be used.

SELF-CONTAINED PORTABLE ELECTRIC LAMPS. Self-contained portable electric lamps are electric lamps that are operated by an electric battery that is designed to be carried about by the user of the lamp.

PORTABLE MOTORS. The term "portable motors" means motors that are intended for service here and there as occasion requires and that are so constructed or mounted as to facilitate moving them from place to place.

STATIONARY MOTORS. All motors not included in the class of portable motors shall be considered stationary motors.

POTENTIAL. The words "potential" and "voltage" are synonymous, and mean electrical pressure.

DIFFERENCE OF POTENTIAL. The expression "difference of potential" means the difference in electrical pressure existing between any two points in an electrical system or between any point of such a system and the earth, as determined by a voltmeter.

POTENTIAL OF A CIRCUIT. The potential or voltage of a circuit, machine, or any piece of electrical apparatus means the voltage normally existing between the conductors of such circuit or the terminals of such machine or apparatus. In alternating current systems the voltage of the system shall be that indicated by a voltmeter.

(a) Any voltage less than 301 volts shall be deemed a low voltage.

(b) Any voltage greater than 301 volts but less than 651 volts shall be deemed a medium voltage.

(c) Any voltage in excess of 651 volts shall be deemed a high voltage.

PROTECTED. The word "protected" as applied to the current-carrying parts of an electric system is taken to mean that accidental contact with such parts is prevented by approved guards.

SHOCK-PROOF. The term "shock-proof" as applied to the current-carrying parts of an electric system (excepting trolley wires) is taken to mean that contact with such parts is prevented by the use of grounded metallic coverings or sheaths.

GENERATING STATION. The term "generating station" means a station in which electric generators are operated by prime movers.

SUBSTATION. The term "substation" means a station in which the current is changed in character, or voltage.

UNDERGROUND STATION. The term "underground station" means an underground place in which there are installed transformers, switchboards, or electrical machines other than portable motors, or any one of them.

SWITCHBOARD. The term "switchboard" means the essential mounting common to several pieces of switch gear or controlling appliances.

VOLTAGE.—See definition of "potential."

DIVISION 1.—GENERAL RULES

MAN IN CHARGE OF ELECTRICAL EQUIPMENT

1. At each mine where electricity is used underground there shall be in charge of the electrical equipment a man fitted for his position by ability, training and experience. The character of the equipment will determine the qualifications of the mine electrician, and he shall be thoroughly familiar with the operation and maintenance of the equipment under his charge.

PERSONS WORKING ON ELECTRICAL EQUIPMENT

2. No person shall be allowed to work on or with electrical equipment of any kind unless he has been previously instructed by an authorized person in the performance of his duties.

CONSTRUCTION AND RATING OF APPARATUS AND RELATION OF CAPACITY TO DUTY

3. All electrical equipment shall be rated in accordance with the current-standardization rules of the American Institute of Electrical Engineers.

4. The rating of each piece of electrical equipment shall be stamped on it or inscribed on a metal plate suitably mounted and maintained upon the equipment. The inscription on the plate shall indicate whether the rating is for continuous or intermittent service and shall be in accordance with the nameplate requirements of the American Institute of Electrical Engineers.

5. All equipment shall be operated within its rated capacity as defined by the standardization rules of the American Institute of Electrical Engineers.

PERMISSIBLE VOLTAGES

6. High voltages may be used for transmission purposes underground, provided that such circuits are carried inside metallic sheaths or coverings with the sheath or covering permanently grounded. This voltage may be applied only to transformers or to motors in which the high voltage windings

are a part of the stationary element. Medium or low voltage may be applied to all electrical equipment.

MECHANICAL CONSTRUCTION OF INSTALLATION

7. Care shall be taken to insure good mechanical construction and neat workmanship in connection with all wiring and the installation of equipment.

PREVENTION OF ACCIDENTAL CONTACT

8. Space shall be provided for free movement where regular passing is required or permitted around all unprotected parts of the electric system, and places where persons must pass close to or adjust permanently installed electrical machinery shall be sufficiently lighted.

9. The standing room around all electrical equipment shall be kept as dry as practicable. At any place where it is necessary to manipulate or adjust medium or high voltage live equipment, including switches, motor starters, and other controlling appliances, excepting locomotives and machines that are moved so frequently that they are provided with trailing cables, there shall be provided and available an insulated platform or mat which may be of a form and character most in keeping with the circumstances of its use, and which shall be not less effective than a dry board 3 feet by 15 inches by ⅞ inch.

10. All metallic frames, casings and coverings, except those of mining machines and drills, that may become alive, shall be permanently grounded.* All metallic pipe lines, 1,000 feet or over in the interior of the mine, and all pipe lines leading outside shall be bounded to the return at ends and at intervals not exceeding 500 feet. All metallic pipes in shafts shall be bounded to the return at top and bottom of shafts.

11. Where danger exists of accidental contact with wires carrying electric current the wiring shall be protected. In haulage roads used as traveling ways the wires need not be protected, if a traveling way of approved dimensions is provided on the side of the entry opposite from the wires. Where wires are run in an entry in which no one but authorized persons are allowed to travel, or where no hazard from contact exists, the wires need not be protected.

12. Weatherproof varnished cloth, rubber, or similar insulation, unless inclosed in a metallic sheath, when used underground will not be considered as a protection against shock.

*It is assumed that the ordinary conditions of operation of locomotives fulfill the requirement of this rule.

13. In untraveled places where the roof is likely to fall all electrical conductors shall be especially protected from injury by falling roof.

CARRYING CAPACITY OF CONDUCTORS

14. The carrying capacity of insulated conductors of distributing circuits shall be determined by reference to the table of carrying capacities laid down in the National Electric Code.

The carrying capacity of bare conductors shall be determined by reference to Table 1, following:

Table—Current-carrying capacity of bare copper conductors used in mines:

Size of conductor B. & S. gage	Current capacity Amperes	Size of conductor Circular mills	Current capacity Amperes	Size of conductor Circular mills	Current capacity Amperes
10	80	250,000	690	750,000	1,520
8	105	300,000	790	800,000	1,590
6	145	350,000	880	850,000	1,660
4	210	400,000	965	900,000	1,730
2	280	450,000	1,050	950,000	1,800
1	320	500,000	1,140	1,000,000	1,870
0	375	550,000	1,215		
00	435	600.000	1,285		
000	525	650,000	1,370		
0000	615	700,000	1,450		

USE OF PERMISSIBLE EQUIPMENT

15. The decision as to where and when permissible equipment is required will be made from time to time as necessary by the properly constituted State authority. The term equipment as here used includes anything in the electric circuit.

See also rules 14, 112, 124, 132, 136, 138, 140, 141, 144 and 164.

INSPECTION AND MAINTENANCE

16. At each mine where electricity is used underground a systematic inspection of all wiring and equipment shall be made at regular intervals, at least once every month. A report of each inspection shall be made by the mine electrician or inspector and a copy of this report shall be furnished to the man legally in charge of the operation of the mine and kept on file at the mine. The report shall definitely state the condition of each underground station, of the conductors and controlling appliances of each main and branch, power and lighting circuit, and of the motors and controlling appliances of each locomotive, mining machine, pump, hoist, or other piece of electrical apparatus connected to the electrical system of the mine.

NOTICES AND WARNINGS

17. Caution notices shall be posted at points where such warnings will be most effective in reducing the likelihood of contact, and prohibitory notices shall be posted wherever electrical apparatus that should not be manipulated by unauthorized persons is installed.

INSTRUCTION FOR RESUSCITATION

18. There shall be posted prominently in every surface and underground station, and at the entrance to the mine, instructions for the restoration of persons suffering from electric shock.

All employees who work with or on electrical apparatus must know how to carry out these instructions without delay.

PLAN MAP OF ELECTRICAL SYSTEM

19. A plan shall be kept at the mine showing the location of all permanently installed electrical machinery and apparatus in connection with the mine electrical system, including cables, conductors, lights, motors, switches, trolley lines, and transformers. The plan shall be of sufficient size to show clearly the location of such apparatus, and the scale shall be not less than 200 feet per inch. There shall be stated on the plan the capacity in horsepower or kilowatts of each motor and transformer and the nature of its duty. Such plan shall be corrected as often as may be necessary to keep it up to date at intervals not exceeding six months.

FIRE PROTECTION

20. Buckets filled with clean, dry sand shall be kept in all underground stations for immediate use in extinguishing fires. The minimum amount of sand thus stored in any one station shall not be less than 2 cubic feet. No sand will be required if two or more approved fire extinguishers are kept in each station.

DIVISION 2. SURFACE AND UNDERGROUND STATIONS, GENERATING STATIONS AND SURFACE SUBSTATIONS

GENERAL RULES OF SAFETY

See rules 8 to 11, inclusive.

GENERATORS

21. Generators shall be installed upon adequate foundations in a dry place free from explosive vapors or inflammable material.

22. Machines generating a voltage in excess of low voltage shall have their outgoing leads and connections entirely within

the generator frame or bedplate or protected by an approved guard.

SWITCHBOARDS AND CONTROLLING APPLIANCES

See rules 36 to 42, inclusive.

Electrically Driven Ventilating Fan—Housing, Power Supply and Attendant

FIREPROOF BUILDINGS

23. All electrically driven mine ventilating fans, together with the housing of the motor, shall be built of fireproof materials. Underground electric fans shall not be used where the air current contains gas or coal dust in explosive mixtures and when used the surroundings shall be fireproofed within a radius of 15 feet from the motor unless this has a permissible casing.

POWER SUPPLY

24. If the line supplying the power is exposed to the influence of lightning, lightning arresters shall be placed near the point where the wires enter the fan house.

25. The fan attendant shall report immediately any stoppage of the fan to the man legally in charge of the operation of the mine, and means for direct communication between the fan house and generating station or substation supplying the power shall be provided.

ATTENDANT

26. The responsibility for the operation of electrically driven mine-ventilating fans shall devolve upon an authorized person.

ELECTRICAL EQUIPMENT OF TIPPLES AND OTHER SURFACE STRUCTURES

27. All electrical equipment on tipples and other surface structures shall be installed in accordance with the rules of the National Board of Fire Underwriters.

28. Starters of motors on tipples shall be provided with a no-voltage release, and if practicable shall be located within sight of the motors that they control or the machines that they operate. A switch or other means for disconnecting the motor from the power supply shall be installed near the machinery.

Underground Stations

GENERAL RULES OF SAFETY

See also rules 8 to 11, inclusive; also rule 20.

29. All underground stations shall be fireproof and well ventilated with fresh air, and shall be wired in accordance with the requirements of the National Board of Underwriters.

30. Ventilation may be accomplished through openings in the walls, but, with the exception of underground stations in which only switches are installed, the openings shall be provided with noncombustible doors that will either close automatically in case of fire or can be closed easily from outside the room by the attendant.

TRANSFORMER STATIONS

See also "Underground Transformers" and rules 30, 36 to 42, inclusive, 84 and 85.

31. Transformer stations shall be so arranged that if a transformer explodes the oil will not flow outside the room.

32. Wires shall be carried on noncombustible supporting framework and the use of wood shall be entirely eliminated. The supporting framework shall be grounded.

33. All transformers in excess of 50 kilowatt capacity shall be equipped with suitable ammeters in either the primary or secondary circuits, or have provision for connecting portable instruments into such circuits.

PUMP STATIONS

See also rules 50 to 72, inclusive.

34. Pump motors operating at voltages exceeding the limits of low voltage shall be wired inside the pump station with approved wires carried in conduit sealed to exclude moisture or sheathed with lead and so placed or protected as to avoid mechanical injury. The metallic covering shall be permanently grounded.

BATTERY-CHARGING STATION

See also rules 29 and 30.

35. For ventilating battery-charging stations, means shall be provided for obtaining the air from the intake ways and discharging same to the returning air way.

HOIST STATIONS

See "General Rules of Safety for Underground Stations," rule 34 and rules 50 to 72.

DIVISION 3. MACHINES AND APPARATUS

GENERAL RULES OF SAFETY

See rules 3 to 6.

SWITCHBOARDS

See also rules 60 to 72 and 75 to 85.

36. Switchboards shall consist of a substantial framework of iron pipe, or structural steel, on which shall be mounted a panel or panels of incombustible, nonabsorbent insulating material that is mechanically strong and has insulating qualities suitable for the voltage at which it is used. All switchboard mountings, instrument transformers and motor casings shall be grounded.

37. The panels of insulating material may be omitted if each piece of equipment carried on the switchboard is provided with an individual base of insulating material of the character specified for the panels and of adequate dimensions, or has its current-carrying parts mounted on approved insulation self-contained in the equipment, which shall be especially designed for mounting on iron pipe or structural steel frameworks.

38. Switchboards shall be so located that there shall be a straight passageway of not less than three feet in front and in back of the switchboards. These three feet passageways shall be clear of all apparatus mounted on the board and shall be kept free of all obstructions. The space back of the switchboards shall be provided with three feet exits at both ends, but shall not be entered by an unauthorized person and shall not be used for the storage of material or clothing.

39. The space behind switchboards where the voltage exceeds low voltage shall be kept closed by locked doors that can be opened from within without the use of a key, but from without with the key only.

40. Where the voltage of the power supply exceeds the limits of medium voltage, the live high voltage metal work on the front of the switchboard within seven feet of the floor shall be protected. In case of existing installations that do not meet the requirements with this respect to passage space in back of the switchboard, no person shall be permitted back of the board while any apparatus or circuits connected therewith are alive.

41. Conductors shall not cross the passageways back of switchboards except below the floor or at a height of 6½ feet above the floor.

42. There shall be provided for each generator an indicating ammeter or wattmeter of suitable capacity, and for all generators a voltmeter that by closing a switch or manipulating a plug connection can be connected to any generator.

Electric Ventilating Fan Equipment

HOUSING AND POWER SUPPLY

See rules 23 to 25.

CAPACITY OF MOTORS

43. Motors that operate ventilating fans shall be of sufficient capacity to drive the fan at the maximum speed of the motor under normal conditions of service without overloading.

CONTROL OF MOTORS

44. Non-automatic motor-controlling appliances that are used with motors that are not self-starting shall be so arranged that the motor will be disconnected automatically from the supply circuit in case the power supply fails.

Electric Hoisting Equipment

SHAFT HOISTS

45. All electrically operated shaft hoists shall be provided with a device approved for the prevention of overwinding. Where the hoist is used for handling men, additional provision shall be made to prevent overwinding at the man landing. Where a separate overwind protection for men is used a visual signal shall be provided to indicate at all man landings that the overwind device is set for hoisting men. It shall not be possible to operate the signal lights without setting the man landing overwind.

46. Shaft hoists shall have a brake that will keep the hoisting drum under the control of the operator. A brake shall be provided with an automatic trip or release that will apply the brake in case the power supply fails, in case of overwinding or overspeeding, and this brake shall have sufficient capacity to hold the maximum unbalanced load.

47. Hoists for handling men shall be so arranged that when hoisting and lowering men and the legal rate of speed is exceeded the hoist will automatically be brought to a stop. If hoists are designed to operate in balance the driving motor shall be of sufficient size to hoist full loads of men in a maximum unbalanced condition in case of emergency.

48. All electrical safety devices shall be tested at the beginning of each shift and a record of such tests shall be made and signed by an authorized person and kept on file at the mine.

SLOPE HOISTS

49. All electrically operated slope, tail-rope, or endless-rope hoists in mines shall be fitted with adequate controlling devices of approved design.

Underground Motors Other Than Locomotives

See rules 3 to 7 and "General Rules of Safety for Underground Stations," and rule 34.

GENERAL CONSTRUCTION

50. Motors for use in damp places shall have approved moisture-resisting insulation.

51. The outgoing leads and connections of all motors shall be protected from accidental contact by insulation or grounded coverings. Motors that operate at voltages exceeding low voltage shall have their outgoing leads and connections entirely within the motor frame or bedplates, or protected by an approved guard.

PERMISSIBLE MOTORS

52. See Permissible Equipment, paragraph 15.

PORTABLE MOTORS

53. The motors and controlling appliances of portable pumps, hoists, and similar portable apparatus shall be securely mounted and with frames grounded to a common base with the machine that is to be operated. All wiring between the motor and the controlling appliances shall be done in accordance with paragraph 7.

54. Mining machine motors and other motors that use a trailing cable shall be provided where the cable enters the frame of the machine with an approved means for preventing abrasion of the insulating covering of the cable. An approved insulating clamp placed within the frame, or protected by an approved metallic covering, shall be provided for taking all mechanical strains upon the cable terminals. (See also rule 55.)

TRAILING CABLES

55. Trailing cables for portable machines shall be especially flexible, heavily insulated, and protected with extra stout braiding, hose pipes, or other effective covering. (See also rule 74.)

56. Each trailing cable in use shall be examined daily by the machine operator for abrasion and other defects, and he shall also be required to observe carefully the trailing cable while in use, and shall at once repair any defect or report it to the person in charge of electrical equipment.

57. In the event of the trailing cable in service breaking down or becoming damaged in any way, or any person receiving a shock from it, it shall be at once put out of service. The faulty cable shall not again be used until it has been repaired and tested by an authorized person.

58. The trailing cable shall be divided at the motor, but only for such length as is necessary for making connection to the motor, and the cable, with its outer covering complete, shall be clamped securely to the motor frame in such a manner as to protect the cable from injury and to prevent any mechanical strain being borne by the signal ends that make electrical connection to the motor.

PERMISSIBLE PORTABLE MOTORS

59. See Permissible Equipment, paragraph 15.

CONTROL

60. Every stationary motor and every portable motor used underground, except mining machines and drills, shall be protected, together with its starting device.

DIRECT CURRENT MOTORS:

61. On two wire ungrounded circuits, each wire shall be protected by an automatic circuit breaker or by a fuse and switch. On two wire grounded circuits, the ungrounded wire shall be protected by a switch and either a fuse or an automatic circuit breaker. When the circuit breaker trips free from the closing handle the switch may be omitted. On three wire circuits each outside wire shall be protected by a fuse or automatic circuit breaker, but no fuse or automatic circuit breaker shall be used in the neutral wire. A triple pole switch to isolate the fuses or circuit breakers from live source shall be used. In case circuit breakers are used they shall be so arranged that the opening of the circuit breaker in one wire will cause the other circuit breakers to trip.

ALTERNATING CURRENT MOTORS:

62. On three phase delta or Y (star) connected circuits, each wire shall be provided with a fuse or automatic circuit breaker. When circuit breakers are used, two overload trip coils shall be used for ungrounded neutral systems and three overload trip coils for grounded neutral systems. In either case the automatic circuit breakers shall be so arranged that the opening of one will open the others. Switches for isolating the fuses or circuit breakers from live source shall be provided. When air break circuit breakers which trip free from the handle are used, the switch may be omitted.

63. The above devices shall be installed in a convenient position in sight of the motor or in sight of the equipment that the motor operates. The controlling appliances of stationary motors, except the controllers of hoists and similar equipment, shall be mounted upon a switchboard. Resistances may be mounted upon a separate metallic framework.

64. Underground motors that operate car or coal-handling equipment shall be provided at a point near such equipment with a switch or other means for disconnecting the motor from the power supply.

65. Underground motors used to drive booster or auxiliary fans shall be so designed or equipped that they will start automatically when their circuits are connected to the power supply.

66. All non-automatic, current-limiting starting devices, except those used with mining machines, drills, locomotives, and hoists, shall be provided with a no-voltage release.

67. Electrically operated mining machines and drills may be protected by a single fuse and need not be equipped with a line switch if an approved current-rupturing device is installed at that end of the trailing cable which is nearest to the power supply. If a hook is used for this purpose it shall be provided with an insulated handle of approved construction. If cable reels are used they shall be provided with an approved means for opening the circuit under full motor load. (See rule 15.)

68. All insulating material used in connection with starting resistances shall be noncombustible. This includes the insulation of wire used for the internal wiring of resistances.

69. All switches shall be so installed that they cannot close by gravity.

70. Every underground stationary motor of 100 brake horsepower or over shall be provided with a suitable meter to indicate the amount of load on the machine.

71. All wiring between motors and their controlling appliances shall be insulated.

72. Overload release devices on starting rheostats and compensators will not be considered as taking the place of circuit breakers if such devices are inoperative during the starting of the motor. If automatic starting devices are used they shall be inclosed in a fireproof inclosure, or mounted upon a metallic framework clear of all combustible material.

Locomotives

73. Gathering locomotives may be operated with a single-conductor trailing cable if the track provides a good metallic return; otherwise double-conductor trailing cable must be used.

74. The trailing cable of gathering locomotives shall be provided with an approved insulating hook or other device for making connection to the trolley wire, and if a double-conductor

cable is used a similar hook or device shall be provided for making connection to the track rail.

Underground Transformers

See "Underground Stations," "Transformer Stations," and rules 84 and 85.

DIVISION 4. CIRCUITS AND CONDUCTORS

Protection and Control

PROTECTION OF ALL CIRCUITS

75. All circuits leading from generating stations and substations except transformer substations shall be provided at their source with current interrupting devices of such capacities and so installed and adjusted that the circuit will be opened if the current in the circuit exceeds the carrying capacity of the conductors leaving the station. All circuits leading underground exceeding 50 kilowatts capacity shall be provided with a suitable ammeter or means for inserting a portable ammeter.

76. Two wire ungrounded direct current circuits shall be protected by an automatic circuit breaker or by a fuse and switch in each wire. Two wire grounded direct current circuits shall be protected by a switch and either an automatic circuit breaker or a fuse in the ungrounded wire. When the circuit breaker trips free from the closing handle the switch may be omitted. Three wire ungrounded direct current circuits shall be protected by a fuse or automatic circuit breaker in each outside conductor, but no fuse or circuit breaker in the neutral conductor, and in addition a triple pole switch to isolate the fuse or circuit breaker from live sources. Where one of the outside wires is grounded this should be treated as neutral and protection provided only in the other two wires.

77. Three phase delta or Y (star) connected alternating current circuits shall be protected by a fuse or an automatic circuit breaker in each wire. When automatic circuit breakers are used, two overload trip coils shall be provided for ungrounded neutral systems, and three overload trip coils for grounded neutral systems. In either case the automatic circuit breakers shall be so arranged that the opening of one will open the others. Switches for isolating the fuses or circuit breakers from live sources shall be provided.

PROTECTION OF CIRCUITS LEADING UNDERGROUND

78. Each outgoing circuit that leads underground and extends over the surface of the ground 500 feet or more from

the generating station or substation shall be equipped with lighting arrestors of approved type, with proper ground connection, at the generating station or substation and also at the point where the circuit enters the mine.

79. Lightning arresters shall be connected on the secondary side of all transformers that feed underground circuits unless there is provided other suitable means for discharging abnormal voltages. Lightning arresters on the primary side will be considered suitable if the secondary circuit above ground is less than 50 feet long.

80. Each power circuit leading underground shall be provided with a disconnecting switch in each conductor capable of opening the circuit under load. This switch shall be located where the circuit enters the mine or within 100 feet of this point.

81. Each individual circuit leading underground, whether alternating or direct current, shall be provided with automatic overload protection at or before the point where it enters the mine working. If two circuit breakers are used they must be so interlocked that both will open in the event of one opening.

PROTECTION OF UNDERGROUND CIRCUITS

82. All branch circuits of a net work shall be provided with current-rupturing devices of such capacity and so installed that the current in any part of the branch circuit cannot exceed the carrying capacity of that part as defined by rule 14, if the length of the complete branch circuit exceeds two miles.

83. Minimum size of conductors used to supply power to coal cutting equipment shall be No. 4 B. & S. Minimum size of conductors for supplying pumps shall be No. 8 B. & S. All conductors supplying pumps and motors shall come within the limits given under paragraph 14.

PROTECTION OF UNDERGROUND TRANSFORMER CIRCUITS

84. All transformers shall be equipped with automatic current-interrupting devices in at least the primary side of the transformer; and also in the secondary side of the transformer if the current-interrupting devices in the primary are not readily accessible from the transformer.

85. When the voltage of circuits entering or leaving underground transformers exceeds the limits of medium voltage, current-interrupting devices shall consist of an oil breaker in each conductor and each switch shall be provided with an automatic overload trip.

86. When the voltage of circuits entering or leaving transformers does not exceed the limits of medium voltage, their protective devices may consist of an oil circuit breaker as described above or of a knife switch and automatic circuit breaker in each conductor, except that approved fuses may be substituted for circuit breakers.

Installation of Surface Circuits

SURFACE TRANSMISSION LINES

87. Power wires shall not be placed on the same crossarms with telegraph, telephone or signal wires. When placed on the same pole with such wires and below them, the distance between the two inside pins of each crossarm carrying power wires shall not be less than 26 inches.

88. Transmission lines operating at voltages in excess of 5,000 volts shall not be placed on the same poles with telephone circuits that are or can be connected underground unless the telephone lines are provided with approved protective devices that are capable of preventing the higher voltage from entering the underground telephone circuits.

SURFACE TROLLEY LINES

89. All surface trolley lines shall be kept at least 6½ feet above the top of the rail and shall be protected at all regularly provided crossings by a guard that will prevent men from coming in contact with the wire either directly or by bringing tools in contact with the wire.

90. That part of the trolley circuit used for surface operations shall be so arranged that it can be entirely disconnected from the power supply without cutting off the current inside of the mine or interfering with the operation of other apparatus not a part of the trolley system.

91. Trolley wires shall not be smaller than No. 0 B. & S. gauge copper wire or No. 4 B. & S. gauge silicon-bronze wire, and shall withstand easily the strain put upon them when in use.

92. Trolley wires shall have double insulation from the ground unless an approved single insulator is used. In wooden pole construction the pole will be considered as one insulation.

Methods of Carrying Circuits Underground

SUSPENSION IN SHAFTS

93. All power conductors installed in shafts shall be covered with approved insulating material throughout or protected in

an approved manner, and shall be firmly fastened to or suspended from properly supported insulators, unless the conductors are sheathed with lead or inclosed in conduit. Conductors used as returns in shafts for ground-return systems shall be supported on insulators, but need not be covered with insulation.

94. Shaft cables that are so constructed that the whole or any part of the cable is not self-sustaining shall be supported in an approved manner at such intervals as may be necessary to prevent the occurrence of undue strains in sheath, insulation, or conductors.

95. Shaft cables shall be so placed or protected that they are not liable to injury from falling material.

SUSPENSION IN BORING HOLES

96. All power conductors except grounded returns installed in bore holes shall be covered with insultation and supported in an approved manner that shall prevent the occurrence of undue strains in sheath, insulation, or conductors.

97. Telephone or signal wires shall not be installed in the same bore hole with power wires unless either the signal or the power conductors in the bore hole are incased in metallic coverings that are permanently grounded.

ENTRANCE OF CONDUCTORS THROUGH DRIFTS OR SLOPES

98. Low and medium voltage power conductors in drifts or slopes may be installed bare, but shall be carried on suitable insulators securely fastened to the sides or roof of the entry. If the drift or slope is used for traveling, the conductors shall be protected as required in rule 105.

Installation of Underground Power Circuits and Conductors

99. All joints in wires shall be made electrically and mechanically efficient either by the use of an approved mechanical connector or by soldering.

100. Underground conductors will not be considered as shockproof unless they are incased in metallic covering that is thoroughly grounded.

101. Low and medium voltage conductors shall be carried at least 6 inches from the trolley line and on the nearest rib side of it, and shall be supported on insulators of an approved type. When the height of the entry does not exceed 5 feet, the insulators shall be placed not more than 20 feet apart and as much closer as is necessary to support the wires properly.

102. If the height of the entry is more than 5 feet, the insulators shall be placed not more than 30 feet apart and as much closer as may be necessary to support the line properly.

103. High voltage conductors shall be carried in metallic coverings and shall be installed in an approved manner with special reference to the conditions under which they are installed.

104. The negative or return wire of grounded systems shall be treated in exactly the same manner as the positive or live wire and afforded the same support and insulation.

105. All conductors in traveling ways except haulage roads used for traveling (see rule 11) and medium voltage conductors in room entries shall be protected throughout that part of the entry that is used for traveling, unless the conductors are at least 6½ feet above the rail, in which case protection will be necessary only at those points where men are required to work beneath the conductors or pass under them. The insulators may be supported directly from the roof or side or may be attached to timbers not less than 3 by 4 inches in size or may be secured to steel mine timbers. The insulators shall be placed so that the height of the conductors above the bottom will be comparatively uniform.

106. All conductors shall be strung with the least practicable sag between the supporting insulators and shall be maintained in this condition and kept from contact with rock, coal, timber, or other noninsulating material.

107. All main conductors shall be sectionalized by approved switches at points not more than 2,500 feet apart.

BRANCH CONDUCTORS

108. Branch conductors shall be supported and maintained in the same manner as main conductors and given the same protection.

109. At the point where branch circuits leave the main circuits there shall be placed a switch for cutting off all current from the branch circuits.

110. Where wires pass through partitions or wooden or other brattices they shall be protected with approved insulating tubes held in place with tape or thoroughly cemented in place so that they cannot move.

111. Entries or passageways in which wires are installed must be kept sufficiently free from rock, slate, or other material to permit ready access to the wires at all times.

ROOM WIRING*

112. Rooms in which gas or coal dust exists in explosive mixtures shall not be wired. Where room wiring is permissible it shall be treated as branch circuits and equipped at the room entrance with switches or some other device that will entirely cut out the wiring when not in use.

TROLLEY WIRES

113. Trolley wires shall be of hard-drawn copper not smaller in size than 1/0 B. & S. gauge and shall be securely supported on approved hangers which may be attached directly to the roof or securely fastened to timber or equivalent.

114. The height of trolley wires above the top of the rail shall be made as uniform as practicable.

115. Trolley wires shall be so placed as to give the maximum clearance practicable and kept in as straight a line as possible.

116. On straight runs the hangers shall be placed not more than 20 feet part where the height of the roof above the track is 5 feet or less and not more than 30 feet apart where the roof is more than 5 feet above the track. On curves the hangers shall be placed so close together that the trolley wire at any one hanger may be entirely disconnected without exposing the locomotive runner to danger of contact.

117. Underground trolley lines shall be sectionalized every 2,500 feet by placing in the line a switch by which the line can be entirely disconnected from the power supply. All branch trolley lines shall be provided with a frog at the point where they leave the main and also with a switch installed at or near the frog, by which the branch can be disconnected from the main.

118. Trolley wires that are less than 6½ feet above the top of the rail shall be protected at all points where men are regularly required to work or pass under them and at all points where men may come in contact with the wires.

BONDING

119. The tracks of all main haulage systems that use a rail return shall be bonded at every rail joint, and cross bonding shall be placed at intervals not exceeding 200 feet. Special provision shall be made for bonding around all switches, frogs, or openings in the track so as to insure a continuous return.

---

*The Bureau recommends that rooms be not wired.

LIGHTING CIRCUITS IN PLACES WHERE GAS OR COAL DUST DO NOT OCCUR IN DANGEROUS MIXTURES

See also rules 133 to 135, 137 to 139.

120. Lighting wires shall be attached to power wires by soldering or by fastening under a set screw in a lug attached to the trolley hanger, or by such other devices as will prevent the wires from becoming loose.

121. All wiring shall be supported on noncombustible nonabsorptive insulators which shall separate the wires by at least an inch from the surfaces wired over. Wires of opposite polarity shall be kept at least 2½ inches apart for low voltage and 5 inches apart for medium voltage.

122. No wires smaller than No. 14 B. & S. gauge shall be used for lighting circuits in nongaseous places.

123. When the ground is used as a return for lighting circuits the return wire shall be attached to the track by bonding to the rail or by attachment to regular bonding in an approved manner. This ground connection shall be made of not less than No. 8 B. & S. gauge copper wire which shall be buried below the surface and carried to the side of the entry and thence on porcelain insulators to the roof or a point at least 5 feet above the track.

LIGHTING CIRCUITS IN PLACES WHERE GAS OR COAL DUST OCCURS IN DANGEROUS MIXTURES*

See also rules 136 and 140.

124. The potential of lighting circuits shall not exceed the limits of low voltage.

125. Only permissible equipment shall be used for lighting circuits.

126. The circuits shall be run from the outside with all switches and protective devices on the surface, or by using permissible switches, fuses, or circuit breakers situated underground, or by ventilating with fresh air the place where the switches and fuses are installed.

---

*Bureau of Mines recommends that in mines in which fire damp is given off, in dangerous quantities the use of lighting circuits be confined to those entries and places that are ventilated by intake air currents which have not passed by or through abandoned or active workings, except that a lighting circuit may be used in a shaft or slope bottom ventilated by a return air current in which the percentage of methane does not exceed 1 per cent.

127. If the circuits are run from the outside with the controlling devices installed on the surface, the conductors leading underground shall be not smaller than No. 8 B. & S. gauge and each circuit shall be provided above ground with a suitable ammeter.

128. Each circuit shall have a double-pole switch and fuses or circuit breakers in the case of two-wire systems, and a three-pole switch and fuses or circuit breakers in the case of three-wire systems.

129. The fuses or circuit breakers shall be designed or arranged to operate when the allowable load is exceeded by 25 per cent.

130. No wire smaller than No. 12 B. & S. gauge shall be used in lighting circuits except for the leads of weatherproof sockets, and these shall not be less than No. 14 B. & S. gauge.

131. In case distribution is made from a point underground, the distribution switches and fuses shall be mounted on a non-combustible panel mounted in a metal cabinet and fitted with a hinged door. This cabinet shall be used whether permissible switches are required or not. The cabinet shall be fitted with a door properly hinged so that it will close tightly and shall be provided with a fastening that will hold the door securely in a closed position.

132. Flexible lamp-cord connections are prohibited except for portable lamps, as covered by rule 141.

DIVISION 5. MISCELLANEOUS EQUIPMENT

FIXED ELECTRIC LAMPS

For wiring and control requirements of fixed electric lamps, see rules 120 to 132, inclusive.

133. Electric lamps used to illuminate haulage roads, side tracks, and similar passageways where gas or coal dust do not exist in explosive mixtures may be connected to power and trolley lines.

134. Lamps may be connected in multiple or in series, and no fuse or switch will be required for one lamp or series of lamps. A switch may be used if it is desired to switch the lamps on or off, and a fuse must be used if it is necessary to protect any considerable length of wire.

135. All sockets shall be of the keyless weatherproof type and have no exposed metallic parts. Lead wires shall be rubber covered and of a size not smaller than No. 14 B. & S. gauge. The lead wires shall be made a part of the socket and per-

manently connected thereto. These wires shall be attached directly to the line wires by soldering or by mechanical connectors. Sockets shall not be supported by the line wires, but by an additional insulator or insulators or some other device that will be entirely independent of the line wires.

136. In mines that contain gas or coal dust in explosive mixtures and in which electricity is used only for lighting, or where the lighting circuits are separate from the power circuits, the voltage of such circuits shall not exceed the limits of low voltage and all lamps shall be connected in multiple.

137. Not more than 24 lamps shall be attached to any one circuit and the power taken by any one circuit shall not exceed 1,300 watts.

138. Permissible mine incandescent lamps shall be used where gas or coal dust occurs in explosive mixtures.

139. Incandescent lamps shall be so installed that they cannot come in contact with combustible material.

140. Electric lamps shall be replaced by an authorized person only, and in places where gas or coal dust exist in explosive mixtures, only after an examination for gas has been made with a safety lamp.

PORTABLE ELECTRIC LAMPS

141. Portable incandescent lamps, other than permissible battery lamps, shall be protected by a heavy wire cage which completely incloses both lamp and socket and shall be provided with a handle to which both cage and socket are firmly attached and through which the cord supplying the current is carried. The socket shall be keyless and the lamp circuit shall be protected by a fuse.

142. When a portable lamp is one of several connected in series between a source of voltage and the earth the portable lamp shall be the one in the series electrically nearest to the earth connection.

143. The use of portable lamps with leads of ordinary flexible cord is prohibited. Only lamp cords approved for this purpose shall be used.

SELF-CONTAINED PORTABLE ELECTRIC LAMPS*

144. Permissible self-contained portable electric lamps shall be used in places where gas or coal dust occurs in explosive mixtures.

*The use of self-contained portable electric lamps of suitable design and construction is recommended for all coal mines, provided that in places where gas or coal dust occur in dangerous mixtures, or in places where black damp is given off in large quantities frequent inspections with safety lamps are made.

ELECTRIC SHOT-FIRING EQUIPMENT

145. Electricity from any grounded circuit shall not be used for firing shots.†

146. Special precautions shall be taken to prevent shot-firing conductors from becoming grounded or from getting in contact with other electric circuits.

147. Only authorized persons shall be allowed to fire shots with electricity in a mine.

148. The electric detonators or igniters and leads thereto shall be suitable for the conditions under which the blasting is carried on and shall be approved by the Federal Bureau of Mines.

149. Portable shot-firing machines shall be of efficient design and shall be substantially constructed. All such machines shall be inclosed in strong, tight casings.

150. Primary or secondary batteries used for shot-firing shall be inclosed in a well-constructed casing provided with a special form of contact plug for making the connection between the batteries and shot-firing leads. The design of the plug shall be such that considerable pressure will be required to make the contact, which will be immediately broken unless the plug is forcibly held in position.

151. There shall be no exposed contacts on the outside of the battery casings.

152. All portable shot-firing machines shall be equipped with a detachable handle, connecting plug, key, or similar approved device without which the shot-firing circuit cannot be closed, and which shall under no circumstances pass from the custody of the person authorized to fire the shots.

153. No shot-firing device shall be connected to the shot-firing leads until all other steps preparatory to the firing of the shot have been completed and all persons have moved to a position of safety.

DISCONNECTION OF LEADS

154. Immediately after the firing of a shot the firing leads shall be disconnected from the supply of electricity, and no person shall approach a shot which electricity has failed to explode until the firing leads have been so disconnected and an interval of 10 minutes have elapsed since the last attempt to fire the shot.

†It is recommended that all shots be fired electrically, and that for inside firing shots be fired separately, and one at a time on account of the danger of causing blown-out shots and resultant explosions. If fired in groups the firing should be done only from the surface.

SHOT FIRING FROM SURFACE

155. In coal mines employing the system of firing shots electrically from above ground when everyone is out of the mine, a complete metallic circuit shall be employed and both wires shall be covered with insulation and supported upon glass or porcelain insulators.

156. There shall be a switch at the mouth of each working place so that the circuit can be kept open while the miners are at work and closed only when the shots have been prepared and the miner or miners are leaving the place.

157. There shall be a locked switch in the circuit at the entrance to each heading or side entry which shall be locked open and be thrown in only by an authorized person when all the men are out of the respective heading or branch entry.

158. There shall be in the circuit at the foot of the shaft or slope two plugs with flexible leads not less than 5 feet long to break further the main circuit of the shot-firing system until all the men in the mine have gone out, when the plugs will be put in by the one man authorized to do so. Provision shall be made for locking the plugs out of circuit.

159. There shall be located in the power house a locked switch to be used for connecting the shot-firing circuit to the generator or power line. The switch shall be thrown in only by the man who is authorized to do the shot firing and not until the men have been checked out of the mine.

160. There shall be located in the shot firer's cabin a locked firing switch which shall be thrown only by the authorized shot firer after all the men are out of the mine and after all other switches have been thrown in. In firing shots, this switch shall be thrown but once.

161. To insure that all men are out of the mine, an approved system of checking shall be employed.

162. All shot-firing lines shall be carefully insulated and the two wires that form the circuit shall be placed on the side of the entry or passageway opposite from that on which the trolley wire is placed, and so far as possible other roads than the trolley road shall be used for carrying the wires into the working places.

ELECTRIC SIGNALING EQUIPMENT

163. The parts of electrical signaling systems used in connection with mines shall be designed, constructed, and installed in an approved manner. No voltage in excess of 25 volts shall be applied to signal circuits in places where gas or coal dust occur in explosive mixtures.

164. Only permissible equipment shall be used in places where gas or coal dust occurs in explosive mixtures.

165. Suitable precautions shall be taken to prevent electric signal or telephone wires from becoming grounded or from coming in contact with electric conductors, whether insulated or not. Signal circuits and telephone wires shall not be installed on the same side of an entry as power conductors.

Respectfully submitted,

(Signed) KARL A. PAULY,
Chairman Committee on Power Equipment.

(Signed) A. B. KISER,
Chairman Committee on Underground Transmission.

MR. PAULY: Unfortunately this report of last year was published too late to circulate and receive comments by our committee in time to act on them for this meeting. As a matter of fact I have only received a very small number of replies to my letter which was sent out with the report. We asked those reviewing the report to reply as quickly as possible, but at the same time to analyze the material in the report thoroughly and give us thoughtful criticism rather than off-hand comment.

I think it will be at least a month or two more before a sufficient number of replies will have been received from the field to make it worth while for us to meet; but immediately after a sufficient number are received, we will again meet and submit a report, which cannot be said to be final because these rules will have to be modified to keep up with practice, but will put it in sufficient shape so that we will feel that it can be safely circulated.

Has Mr. Kiser sent you any report?

CHAIRMAN ROBERTS: Something similar to yours.

MR. PAULY: We have met jointly and I discussed the situation with him and my statement is based on the joint opinion of both of us.

CHAIRMAN ROBERTS: Thank you, Mr. Pauly.

Mr. Kiser is chairman of the Committee on Underground Power Transmission that rendered the joint report with Mr. Pauly's Committee on Power Equipment last year. Mr. Pauly's remarks apply to the work of the committee of which Mr. Kiser is chairman, and I will therefore make no further comment on that report.

DISCUSSION ON UNDERGROUND MINING AND LOADING MACHINES

CHAIRMAN ROBERTS: Our next report should be from the Committee on Underground Loading and Mining Machines, of which Mr. C. A. Cabell of Charlestown, W. Va., is chairman. As I advised you in my report for the General Committee reviewing all these reports, this Committee rendered no report. I was in hopes, however, of being able to get together two or three members of the Committee that are in the city and to have a program prepared at least that could be presented to the Conference for consideration, but I have been unable to get those gentlemen together and to prepare that program. However, Mr. Farnham, one of the active men on the Committee, is present and he reviewed very carefully last evening the correspondence that the chairman of this Committee has had with the members and having reviewed that, I would

like very much to have Mr. Farnham make a brief statement to us, which is all that we can have at this time on behalf of the Committee on Mining and Loading.

MR. FARNHAM: The recommendations and reports sent in by individual members of the Committee to Mr. Cabell concur with the previous recommendations made for standardization. The first and most important is a uniform mine track gauge which they recommended to be 42 inches. These reports I have are from representatives of the Loading Machinery Manufacturers and they speak of the necessity of some improvement in the placing of cars at the mine faces and standards to be adopted in the transportation which will make the loading machine operations successful. Loading machines have been built and have shown their capacity and ability to load cars in a very short space of time, but they have not been adopted broadly today for the simple reason that the transportation improvements have not kept pace with the improvements in the loading machinery.

The Committee believes that it is necessary to formulate some plans or sets of standards for mine development and operation which will be necessary and their adoption will be necessary before this class of machinery can meet with a widespread success.

These two points are the main ones that have been brought out. In fact, I am quoting rather largely from Mr. Levin's letter, who I see is present, and I think Mr. Levin might say something on that question.

CHAIRMAN ROBERTS: Mr. Farnham has suggested that we have another member of the Committee present, Mr. N. D. Levin, Chief Engineer of the Mining Department of the Jeffrey Manufacturing Co. speak. We would like very much to have Mr. Levin make a statement to us on behalf of his Committee.

MR. LEVIN: I really have nothing further to say than what Mr. Farnham has already said; that is, that there are already a good many loading machines on the market, but so far they have not been used extensively because the mines are not arranged to handle the coal, they don't supply the cars without interruption and they don't seem to manage to have places cut and ready to load, so there are really two things needed. One is coal to load and the other cars to load it into. The machinery is already available.

That is all I have to say.

CHAIRMAN ROBERTS: There is another member of this Committee in the city, but he is not in the room, Mr. William Whaley, one of the manufacturers of loading machines, and I regret very much that he is not here.

I would like to make a brief statement on behalf of this Committee. I have interviewed the members of this Committee and written to the chairman and the burden of their alibi has been that loading machines were too new to standardize, and I have not been able to impress on the members of this Committee or their chairman that they are to consider and recommend to this body a standardization of mining and loading machines. Mining machines are not in the initiative stage by any means —they have been in use for many years and are commercially developed, and we have not had word from this Committee regarding half of their subject. It is something that, to my mind, is a very large subject and I think a sub-Committee should have been formed to consider and report back to the main Committee.

I agree entirely with the Committee regarding the status of the loading machine, but if I were directing the work of this Committee, I should have taken it up somewhat in this manner, which is following the method of our other committees in handling their work. The very fact that the loading machine is a recent invention and not fully developed and perfected, to my mind gives the very best opportunity for the work that we are trying to do on behalf of equipment. The men who are taking up equipment that is fully developed will have a great deal more difficulty

in steering a standardization program than the man who is taking up equipment that is in the development stage. And if this Committee would work out a comprehensive program for the development of that machine, or any type of machine, point out the difficulties to the mining industry of the adoption of that machine and what the mining industry can do to promote its use, this Committee would be doing a very great service to the mining industry, not only in Coal Mining but in Metal Mining.

From my conversation with men who have used machines and men who are marketing loading machines, it is evident that present mining methods are not such as could make the use of the loading machine as advantageous as it was hoped it would be or as advantageous as it should be—in other words, people that install these loading machines at the present time do not get the full benefit of that equipment that they should derive.

There is no question in my mind whatever that the loading machine is going to be developed and perfected and is going to come into general use. It is a natural consequence of industrial conditions in America, and especially in the mining industry. If the men who are promoting this enterprise had not foreseen that, they would not have spent many thousands of dollars in developing that machine. They knew the mining conditions, they knew that those mining conditions were such as to warrant spending money on a loading machine; but as I have said, our present mining methods do not seem to make the best and largest use that they should of the loading machines and it is quite possible that, to secure that proper value from these machines in commercial use, we may have to quite largely change our mining methods. If thereby we can load coal for a fraction of what it costs to load it now, we can afford to change our mining methods, especially in new mines, mines that are being now developed or will be developed in the future.

Therefore, to my mind this Committee has a very large service to render to the industry and I am greatly disappointed that this Committee has not brought in a report for this Conference. The only excuse I can offer for the Committee is the one I gave you in my report yesterday, that the chairman of the Committee, who has to direct the work of the Committee of course, has been overwhelmed in his regular daily duties in West Virginia until they sent him to take a rest cure. That is really the reason that this Committee did not render a report, although I do believe that the members of the Committee, as well as the chairman, need this new vision of their work, and that is why I have taken the pains to present it, because I think they have a large field of usefulness.

We have no report, but this transcript will be written up and will be digested and put into the next "Standardization Bulletin." Therefore I would like very much to have some of the men in this Conference express their views on this subject, and it will become a part of the working material on which this or a reorganized committee will develop this valuable subject. I would like to hear from someone on this. Mr. Hood, I would like to have you add to this discussion.

MR. HOOD: I am afraid I have little or nothing to say on this subject because, as Colonel Roberts has well stated, it seems to be a matter of correlation of mining methods with new mechanical equipment, which demands a change on the part of the mining man. My interest lies particularly in the mechanical end and in the machinery end; as Colonel Roberts says, the machine is a pretty good machine so far. It will do more than it has been asked to if given a chance.

I am sorry Mr. Rice is not here because, representing the mine interests of the Bureau, this would naturally fall in Mr. Rice's division.

CHAIRMAN ROBERTS: We have quite an array of talent at this Conference. I will be greatly disappointed if someone does not add some ideas on this subject. I would like to learn whether this Conferenece agrees with the general statement of the possibilities of this subject that I

have enumerated or whether they do not agree with me. Don't hesitate to disagree because we must develop what the sentiment of our Conference is before this Committee will be justified in pursuing this subject. In other words, they will not be justified in pursuing this subject because I think it is a good thing to do, it will be because this Conference says it is a good thing to do. I would like to have some more of you express yourselves pro or con.

MR. LEVIN: You stated that we ought to develop machines, loading machines. I want to emphasize the fact that the loading machines are already developed. There are several good, practical loading machines on the market. The company I am connected with brought out a machine in 1908 that would load a ton a minute and better, but still it was not a paying proposition. It was tried out in a good many mines in different coalfields but it was always the same, the pit boss would not provide cars, or they would not have a room undercut or shot or the car was off the track or something, so that we had to give it up. We have developed a first-class loading machine, but it was not practical. The mine officials did not realize that they had to do their part.

Later on we developed a small, inexpensive machine that does not pick up the coal from the bottom but the men shovel the coal onto it. That machine pays in almost any kind of a mine and it seems as though that type of machine is the thing to use in all the mines. Operators realize that they have to arrange their mine and systematize it before they can use a more expensive and a larger machine. There are machines of both kinds on the market at the present time and it is up to the mine operators —I think that this Committee ought to make that clear—the mine operators have got to do their part of it. The manufacturers have spent hundreds of thousands of dollars and no result has been obtained so far. It is up to the mine operators.

MR. FARNHAM: I would like to say something on behalf of the Committee. As one of the members of this Committee that is somewhat under fire for lack of work, I must say on my own behalf that I have been out of the country for nearly half the year and found quite an accumulation when I came back. I have noticed, however, that the only three members present out of quite a large Committee are representatives of manufacturers. There are an equal number of coal mining men on this Committee. Mr. Levin has just mentioned the difficulty of getting coal mine men sometimes to fix tracks and do other things underground. This Committee finds difficulty in getting them to come around to their Committee meetings. If we could get together in a fair-sized meeting, I know we could dispose of some of these matters very quickly.

MR. HUNNER: I don't know whether it would interest the gentlemen present to know what our experience has been in the Lake Superior district or not. We are shipping normally about fifty million tons in a season. That is just about half of the production from underground mines. About ten years ago the first loader was developed, called a Hulby loader and since that time there have been at least four or five different machines developed in that district that have had more or less success in operation. The two machines that are in use today are the Hole Loader and the Shove Loader.

CHAIRMAN ROBERTS: Will you kindly state what you are loading?

MR. HUNNER: We are loading iron ore. The Lake Superior district is an iron mining region. I thought you all knew that. The two machines that I have just mentioned have given the best success. The machines will stand up and they will do the work but our great difficulty up there is to develop our underground operations so that it is possible to use these machines. I might say that, in that connection, I know something of operating myself. We are operating normally twenty-two mines and we have used three different machines. To date I would not say that the machines are a success excepting in straight-away develop-

ment work as compared with the use of common labor. We have gone to the trouble of endeavoring to change our mining system so as to accommodate the use of these loaders.

In stoping operations where you are stoping in large rooms, there is no question but what the machines are a success, but where you are operating with small clearances as we have to operate in an iron mine where we are mining soft ore, the conditions are quite different and they work against the use of the loader.

The two loaders that have been used there principally will operate within a five-foot radius and that will give you something of an idea of the necessity of keeping the size of the machine down, otherwise it would be impossible to use it.

The crushing conditions of the timbering are such that it is impossible to move these machines from place to place if they are not built small in size and when you build them small in size, of necessity you have got to give way to strength because a smaller machine is more apt to break down frequently. As I stated before, our real success in the use of these machines has been in developments where the matter of time was the principal consideration. Where we were rushing the work we found the machines adaptable to our conditions, and also stoping in the larger rooms.

MR. LEVIN: I want to state that my remarks refer to coal mines. I know that in iron mines they have done a whole lot more to meet the manufacturers of loading machines half way.

(Note. After considerable more discussion the Chairman put the question as to whether the work of this Committee should be continued, and it was decided to continue the work.

After another long discussion it was decided to eliminate the word "sub" from the term "Sub-Committee" and that henceforth these subcommittees are to be known as "Committees," and that the sectional committees will be called "Sub-Committees" and given numbers whenever necessary.)

CHAIRMAN ROBERTS: Having completed our program for this afternoon, if the members have nothing further to discuss, we will stand adjourned.

The meeting adjourned at 5:30 o'clock.

ADJOURNMENT.

(Note. The following discussion on Loading and Mining Machines was taken from the Wednesday morning Joint Session of the Metal Mining and Coal Mining Branches.)

CHAIRMAN ROBERTS: I promised that if we could get hold of Mr. Rice, the Chief Engineer of the Bureau of Mines, we would have him speak to us briefly on the work of the Committee on Mining and Loading Machines. This Committee, Mr. Rice, laid down on us, didn't give us any report, but we had a very interesting discussion when we called on Mr. Hood for some advice as to the standardization of mining and loading machines; he said he was a mechanical engineer, but that if George Rice was here he could tell us something.

So we inveigled you into this session this morning and now I would like to have you make a few remarks on that subject, but I will make it a little plainer as to what we want.

You know we are trying to standardize. This Committee on Mining and Loading Machines has not apparently quite got the cue yet and they have not standardized anything. They have not given us any recommendations for standardization; yet, in the discussion yesterday they developed considerable interest in standardization of mining and loading equipment, etc.; and after quite a full discussion, the session voted that

this Committee was to continue its work or we would reorganize it and get a Committee that would do the work.

So the standardization of that classification of equipment is going to go forward either under that Committee or a reorganized committee; but we want to get into the records for that Committee as many good suggestions as possible as to what might be done. What can that Committee do for the benefit of the mining industry on the standardization of mining and loading machines, not just loading machines, but also mining machines, which have been on the market for a long time.

I suggested further that there is another smaller classification of materials that should come under the work of this Committee, viz.: miners' lamps. This had not been allotted to any Committee, and I think that miners' lamps, and possibly some other things that had not occurred to us, should go to this Committee. Miners' lamps is a subject that is up now to the General Committee for allocation to somebody, and I suggest this Committee take it. I think it properly belongs to them.

At any rate we would like to hear from Mr. Rice, Chief Engineer of the Bureau of Mines.

MR. RICE: That is an unexpected surprise—I can't say it is a pleasant one. I think I will have to pass the buck, as some others have done before me. The problem is a pretty big one. If it had been loading machines alone we could perhaps have said, as Colonel Roberts suggested, that they were rather too new to arrive at any conclusions. Of course mining machines have been longer with us. I suppose the plan must be rather one of standardizing the use rather than the machines themselves.

CHAIRMAN ROBERTS: Correct!

MR. RICE: Because otherwise I think it would tend to kill initiative in developing new apparatus. I rather feel that if you really want to get something into the records, it might be desirable if some written statement were prepared, perhaps jointly. I was not serving on this Committee at all and so I don't feel that I have to apologize in any way. The thing, as you must realize, is a new one to me and the thought of such standardization, for when you come to standardize the use offhand, for instance in coal mines, it would be something like standardizing coal beds, and we can't do that very well.

If it comes to a question of safety, why that is a different matter because there we touch perhaps on the dust problem both as a matter, if it is coal dust, of the possibility of ignition of the dust, or again as an unhealthy thing to breathe, although we have not heretofore considered that soft coal was unhealthful from the standpoint of injury to the lungs; at least statistics have not shown it.

In the matter of ignition of gas, there we are touching on the electrical problem which I believe you have already under way from another point of view.

CHAIRMAN ROBERTS: That is under another Committee.

MR. RICE: But the performance of cutting and the like, it seems to me, is an extremely difficult thing. I would be glad to discuss it with others and perhaps submit a paper at a later time, but at present I would like to draw out from the Chairman and others just what you can standardize in use. The use of mining machines, speaking of coal, is so much affected by the method of mining that you may adopt and we are constantly looking to improvement in the method of mining. That is to say, with certain kinds of machines, like the old machine (which has been practically discarded now) you had to keep your props well back from the face; it was not adapted to long wall or semi-long wall. The present machines are better adapted in that way.

I am myself looking for light. When it comes to the question of loading machines, I may say, if you want to touch on that, Mr. Colburn of the Bureau of Mines has devoted the better part of the year to a study

of loading machines throughout the country and perhaps may make some suggestions along that line.

MR. HOOD: In justice to myself and Mr. Rice, the particular "buck" that was passed to Mr. Rice yesterday was this: as I understand it, the loading machine has been developed so that it will perform its function. The trouble is to keep it busy. That apparently requires a new method of mining and transportation, and it is on that particular point that they were groping, and I am quite sure that if Mr. Rice would speak to that point, it would supplement yesterday's discussion.

MR. RICE: Does this refer especially to metal mining or coal mining?

CHAIRMAN ROBERTS: More particularly to coal mining. They seem to have solved their problems in adopting their methods to a larger use of the loading machine in metal mines than in coal mines.

MR. RICE: I would not say it has been solved in metal mines by any means. You take scrapers, which have been so extensively used now and are coming in more and more; I think Mr. Colburn will bear out the statement that there is a very considerable amount of study that we think needs to be done looking perhaps to the modification of the method of mining in order to fit perhaps the shovel, or to change the scraper in order to fit the method of mining. The Bureau of Mines now has a man who is giving that matter a great deal of attention in the Joplin District, where the operators have made a specific request for help in that particular connection.

The tremendous variety of ways and the inter-relation as between the method of mining and the kind of machine makes it very difficult for me to visualize just now how you are going to standardize. So you see I am not very helpful to you in that respect.

Similarly in coal there is again an inter-relation of mining methods to the machine which makes it difficult to standardize. If you standardize the use of the machine you have got to have a fixture, as I see it, of the method of mining and we are not satisfied yet, either with the loading machine or with the method of mining because they are looking for betterment.

I personally would not like to go very much further without having a chance to study that a little bit more and hearing discussion by others.

MR. DALY: This is a very interesting subject to me. For a long period of time I have been trying to get somebody, somewhere, somehow to come to this mechanical loading in metal mines. I don't think we can bring the mine to the loader, we have got to bring the loader to the mine. I was in hopes he would touch on that. That is what I am trying to urge him up to now.

In the metal mines, particularly in some of the fissure vein districts, the conditions are such that we don't have very large ore bodies at any given point. We have a multitude of them, very many of them, but not enough to take in large headings, large haulage systems or large shovels. On our different levels we have several faces, but we may not have faces enough upon any given level to keep a loading machine occupied.

For that reason I would be inclined to want to find out some information as to the manufacturer, if one exists, who makes a shovel small enough to go on a cage without disconnection and can be transferred from level to level.

Mr. Rice, do you know of anybody who is doing that sort of thing?

MR. RICE: I do not, but I suggest that Mr. Colburn, who has made a specific study of that, could tell us what has been done.

CHAIRMAN ROBERTS: You gentlemen have not quite got the cue yet. While this comes under the subject of standardization, we are not so earnest about standardizing the loading machines as we are to try to adapt the loading machine to some method so it will come into use. They say they have several good loading machines on the market but there is no extensive use of them.

MR. DALY: They are all too large for the greater percentage of metal mining operations.

CHAIRMAN ROBERTS: I just saw Mr. Needham, president of the St. Paul Coal Co. and the Republic Coal Co., and a few others, who was going to leave, and I gave him the high sign to wait because I wanted him to tell us something about his difficulties with loading machines. It is a big subject and we want to try to do something for the men who have spent many thousands of dollars in producing these loading machines. Possibly we had better adjourn then until 2:30.

MR. DALY: I believe the manufacturers of loading machines don't realize the field that they will have to work in if they will develop a type of loading machine for a metal mine, of small latitude.

CHAIRMAN ROBERTS: In the meantime we will telephone down to the manufacturers at the Coliseum and try to get them up here at 2:30, and give them a chance to answer our questions.

The meeting then adjourned at 12:15 p. m.

(Note. The following discussion on loading and mining machines is taken from the proceedings of a joint session of coal mining and metal mining branches Wednesday afternoon.)

CHAIRMAN ROBERTS: When we adjourned this morning it was with the understanding that we would meet at 2:15 to allow a few minutes to continue the discussion of mining and loading machines.

There are two or three gentlemen present whom I should like very much to have give us a brief talk on the possibilities of the loading machine, not necessarily on the standardization of loading machines, but more particularly on what can be done to enable us to make a larger use of loading machines. In other words, if the industry as at present conducted and according to the present operations, does not make the proper and largest use of loading machines, we would like to have that go into our record; and also information about anything that can be done that will enable a larger use of loading machines. That information will be of value to our Committee in pursuing their work.

I would like to have Mr. Needham discuss this briefly, making any suggestions he can. Mr. James Needham, president of the St. Paul Coal Co.

MR. JAMES NEEDHAM: I made the statement in the Conference in Denver last year that we have in Northern Illinois a problem that is very difficult to solve in the matter of loading appliances. As far as I know, there is nothing on the market now that would meet our conditions. I was rather hopeful that, when the matter was brought to the attention of the manufacturers last year, something would be attempted, but as far as I know nothing has.

I do not believe that I have any suggestions to offer. The only things that I have tried out (and I have tried some in a crude way) have all met with disaster. That is, they have not been satisfactory or practical. The drag system seems to be altogether unsuited to our conditions. We have a space about three feet square at the face in which any machine would have to operate, not more than three feet, and to be of material benefit to us it must convey coal a matter of 100 feet. Mr. Smith says 150 feet, but in any event not less than 100 feet and through an opening about three feet square.

If anybody can give any suggestions as to a possible solution, I am sure I would be very glad to take advantage of it. Anything that we have tried or seen appears to us to be impractical.

MR. LEVIN: I would like to know a little more about what the conditions are? Is it a semi-long wall system?

MR. NEEDHAM: It is a long wall system.

MR. LEVIN: What is the length of the face?

MR. NEEDHAM: It is circular, and continuous.

The advantage to be gained by any loading device is not merely the question of getting the coal into the cars so much as it is the elimination of brushing. We now have to brush each roadway a matter of three feet and these roadways are driven every 42 feet. So any loading device would have as its main economy the elimination of brushing.

MR. LEVIN: Where is this mine located?

MR. NEEDHAM: All Northern Illinois mines, and of course Kansas and Missouri, to a greater or less extent.

MR. DALY: In order to get the metal mining part of it before the meeting I think some of the gentlemen present this afternoon who were not here this morning should know the requirements of a metal mine. We thought our requirements were a bit difficult but I find your requirements are more difficult. We would not have to meet a condition of that kind in metal mining.

What I had in mind for metal mining, particularly for fissure veins, would be a shovel small enough to be transferable without disconnection on a cage in a shaft that is 4½x5 in the clear of timber. It would have to operate in a drift or cross-cut about 5x7 feet. There is no long pull from the shovel. We would not require that. We would carry our car right up against the back end of the loader.

What I am trying to encourage from the metal mining standpoint is the development of a satisfactory shovel that will load from a cross-cut or drift 5x7 feet and throw it into a car immediately behind the shovel.

MR. LEVIN: You refer to a shovel right along. Why should it be a shovel? Wouldn't any other device do just as well?

MR. DALY: I would welcome any other device that would be satisfactory. I merely mentioned the shovel in a general way. If it will put the rock from the face into the car, that is all I want, whatever the device may be.

MR. LEVIN: I want to ask a question. Suppose a small, compact conveyor was made that has a horizontal part about six inches high or so, and elevates the coal into the car?

MR. DALY: This is metal mining, not coal.

MR. LEVIN: I know that. Are those piles very steep ordinarily after it is shot?

MR. DALY: They are not steep; they are flattened out.

MR. LEVIN: I had an idea that a simple machine might be made that would be simply a conveyor.

MR. DALY: What would be the principle of the loading part, a drag or push?

MR. LEVIN: Just an ordinary conveyor that carries the coal up into the car. Put the nose of that conveyor against the pile and scrape it down, pull it on with a scoop and shovel the last of it. It is much easier to shovel onto a conveyor that is about six or eight inches high and then to lift the coal into the car. Such a machine could be made that would weigh only about 2,000 pounds and be a very inexpensive machine, easy to move about the mine.

MR. DALY: Do you think that the drag method would be as successful as the push method?

MR. LEVIN: I don't know.

MR. DALY: That is a point I would like to make.

CHAIRMAN ROBERTS: He is not figuring on the machine doing any shoveling. He wants to know if it would pay, in your application of the loading machine to furnish you a machine that, after you had shoveled the material onto the conveyor, it would do the loading for you.

MR. DALY: That would not be of any value because, if you shovel it onto the loader you can shovel it onto the car just as well.

CHAIRMAN ROBERTS: You didn't get his point. He thought it was cheaper and easier to pull the coal onto a conveyor six inches high than to shovel into a car three feet high.

MR. DALY: That would not be of sufficient importance. The loading of metal in a fissure vein is onto a small type of car from seven-tenths of a ton capacity up to a ton, and the height of the car is only about 34 inches above the track. So it could be shoveled almost as easily, so far as economy is concerned, into a car as a conveyor. The difference would not be sufficient to warrant the installation of any conveyor.

What I had in mind was a mechanical device that would shovel that rock into the car.

MR. LEVIN: We get the same answer from the coal operators. We can actually prove that it will do away with half the labor, speaking conservatively, but they say that they want something that will do the whole thing.

MR. DALY: That is it exactly.

MR. LEVIN: The time has not yet arrived when we can do that because the mines have not been systematized and their men have not been organized so that such an ideal machine can be used. Therefore, I advocate doing the best we can at the present time, and that is to use a simple contrivance like this that would actually cut the labor by half. In any other business they would consider ten per cent reduction of labor a very good thing. Here we actually lessen the labor by half and they will not listen to it.

MR. DALY: I will have to take exception to the statement that it will reduce the labor half by means of that kind of a thing; it can't be done.

MR. RICE: Before we pass away too far from Mr. Needham's problem, I want to say that I have some familiarity with his problem, inasmuch as I have acted in the capacity of engineer and superintendent of mines in the northern Illinois field and know something of the difficulties that he speaks of.

In my experience in visiting the various places, I think that what comes nearer to solving this problem (and yet I can't say positively that it could be satisfactorily worked out) is the system which they are using in Scotland where they are working in coal beds from 16 inches to 2½ feet thickness, and are using a conveyor for the purpose, a trough conveyor which can be separated at intervals and dragged diagonally through the timbers. They have a systematic timbering there as they are required to have generally in England. The posts are about three feet apart and they use straps, as we would term them, over the two posts 6 feet long and sometimes they are hitched into the coal face. A temporary post is set up under the free end close to the face until under-cutting is done.

The conveyor is between the line of props and the permanent props and the one behind. It runs from there to what they term their gate or where the cars are running. The bottom is brushed in that case and the conveyor discharges into the cars. The face is made in the step form so that the cars are ahead of the face, and the coal is loaded by hand onto the conveyor.

The great gain is that the conveyors are about 300 feet in length, so that they do away with the several intermediate gates, or as we would call them in the Northern Illinois field, rooms or branches, and in that way lessen the maintenance. The system was working very efficiently when I saw it in 1911, and I understand it has been since. Col. Wilson, the British representative who came to our conference at St. Louis on the standardization of mine apparatus, spoke of their successful use. He had been until recently working in the Scotch district.

It is very difficult to compare, from my observation in the past. They have made a point over there in their long wall work—William Garfield has written quite a little about it in his mines—of the importance of keeping a straight face for long wall work. I mean a straight face as far as any piece of long wall work is concerned. He has made his

cut such that he is able to put into the new line of posts and he intensifies his speed.

The speed in the long wall mines worked by hand has in the past been too slow. It is very likely to bury the machine in case it didn't go in fast enough.

In their thin beds they have used these conveyors, and Mr. F. M. Warren, the electrical engineer of the Delaware, Lackawanna & Western mines, who was in my party, was so much interested in the use of the conveyor which he saw there, that he has adopted it for the anthracite beds in Eastern Pennsylvania.

I think that there is a great deal that can be done in that way. It is a question of very systematic work, but the Scotch are certainly able to handle it admirably in the mines that I saw.

With regard to the saving, I think I can say that it isn't alone a question of saving ten per cent of labor. You have got to consider the cost of the machines in the metal mines; you have got to consider that the wear is very terrific and I think that Mr. Colburn can give you some very interesting information about his visits throughout the country on behalf of the Bureau of Mines. He found in many places where the machines are most important because of the scarcity of labor at the particular time; but the repairs on the machine with the grit and cutting on the bearings was terrific. The first year they went all right but after a while the wear was so great that it became a very serious problem as to whether they paid.

MR. NEEDHAM: I will say for the benefit of the gentleman who spoke a moment ago, it will be quite an item to us to have the coal delivered, even though it has to be shoveled into the car afterwards. That is not our difficulty. As Mr. Rice intimates, the big item of expense which we would avoid is the brushing of the respective roadways in this territory which we could cover by the 100 or 150 feet where we now drive them 40 feet. It would be quite an item if we could eliminate that brushing, even though we had to shovel the coal into the conveyor after we got it to the head.

CHAIRMAN ROBERTS: All the recess hour I have been trying to locate Mr. Whaley. He has just gotten my message and has arrived. Before Mr. Colburn spoke I wanted him to reply, while these inquiries were fresh in his mind. He has listened to this discussion. Mr. Whaley is a manufacturer of a loading machine and I would like now to call on him.

MR. WHALEY: I was not here during all of the discussion and I have not the question clearly in mind as to the information that is wanted.

CHAIRMAN ROBERTS: Mr. Needham, will you put the vital question that must be solved in order to make the loading machine applicable to your conditions.

MR. NEEDHAM: We operate on the long wall system using the 45 degrees in the complete circle. The timber is set about three feet from the face, and we are using now a cutting machine with a four-foot cutter bar. The roof is strapped. The space between the face and the first set of timbers must be kept to three feet with practically a three-foot seam, and we would want the coal conveyed a minimum of 100 feet or 126 feet to make the three room widths. We don't think anything less than that would pay, and some think that the coal ought to be conveyed at least 150 feet. That would be on each side and would leave three feet from roadway to roadway, taking half of it from one roadway and half of it from the other.

We would not object to the coal being shoveled into the conveyor, and reshoveled into the end of the conveyor if necessary. We think, however, if the coal can be conveyed to the roadway, that provision can be made to load it into the car, but that is not our difficulty. Our diffi-

culty is getting it from these remote parts of the face through this narrow channel on to the roadway where it can be loaded into cars.

MR. WHALEY: What is the thickness of the coal?

MR. NEEDHAM: Thirty-six inches—from 30 to 40 inches.

MR. WHALEY: As I understand it, we have a space of three feet between the face of the coal before it is shot and the timbers, and after it is shot we have a space of seven feet in which the loose coal lies.

MR. NEEDHAM: It is not shot—I forgot to mention that. It is taken down by hand. The pressure operates to break the coal down, and we get it by hand.

MR. WHALEY: Well, sir, I think that a loading machine man would have a hard job helping you out.

MR. NEEDHAM: I agree with you.

MR. WHALEY: It looks to me as though that is a conveyor proposition and to put the coal into the conveyor by hand. As far as my limited knowledge of the subject is concerned, I think that that is the only present solution.

MR. NEEDHAM: If you will permit me to interrupt right there, I would like to say a conveyor could be built—there is no question about it—to convey that coal out through that channel. Our idea is to handle the conveyor after the coal is loaded out and the machine comes through. That is where we can't see our way clear. It must be of sufficient flexibility to practically eliminate it after you get through loading the coal, because the machine comes through and takes practically all the room.

MR. WHALEY: Well, sir, the machine can't take over three feet, can it, between the face and the props? The machine takes up three feet between the face and the props, as I understand, and there is no room for the conveyor there. The only solution that I can see of that would be a conveyor in short sections which can be put together between the row of props and the coal after cutting is done. Another solution, I think, might be to have a conveyor back of the first row of props, moving the coal over to the conveyor between the first and second row of props.

However, I might say, Colonel Roberts, that this is a little bit outside of the province of the loading machine for we would not attempt to attack that as a loading machine proposition. That is a loading system problem all right for conveyors and the proper arrangement of same.

MR. DALY: On behalf of the metal mines I perhaps could give you something to work on. There is a vast field for a small shovel in metal mines if one could be developed to operate successfully and economically. Our conditions that would have to be met would be a shovel small enough to put on a cage and transfer from level to level without disconnection. The shaft averages about 4½x5 feet in the clear of timber. Of course the cage takes up some room and you would have to figure on a shovel small enough. It also has to operate in a drift or cross-cut five wide and seven high. That would be more in your line.

MR. WHALEY: As I understand it, the machine could not be over 5 feet long?

MR. DALY: It could not be that length; four and a half would be the maximum length and about 36 inches wide and about four and one half long.

MR. WHALEY: What size material are you required to handle?

MR. DALY: Up to nearly a foot cube.

MR. WHALEY: That looks like another case where your limitations of space require so small a machine that it is imposing a herculean task upon a pigmy.

MR. DALY: The dipper can be made smaller in proportion so that there will be more dippers to fill a mine car than the larger shovels at the present time.

MR. WHALEY: That type of machine would have to be a machine, gentlemen, that would deliver direct to the car without the use of conveyors, unless the conveyors were of such a nature that they could be folded up readily.

MR. DALY: This shovel could run on the track right up to the face and the car immediately behind it so that the duties to perform would be to load that and throw it back into the car.

MR. WHALEY: I judge that most of the gentlemen present are familiar with the different types of loading machines now on the market.

MR. DALY: But they are all too large for us.

MR. WHALEY: But the type of machine to be developed along the lines you require, to be four and a half feet long and to be small enough to work in a drift five by seven, would have to be not over four feet wide and not over five feet high. The types of machines now developed are the machines with a swinging boom such as the Thew which is somewhat like an ordinary steam shovel——

MR. DALY: That is a little too large.

MR. WHALEY: Or the Armstrong shovel that passes the material directly back from the ground into the car.

MR. DALY: That would be the ideal shovel for us to use.

MR. WHALEY: I am inclined to think so, too, although that is not the type of shovel that we manufacture. The Myers-Whaley is an automatic shovel which picks up the material and delivers it to a conveyor which carries the material back into the car. There are three different types of machines. I would suggest for these conditions, the limitations suggested here, the shovel loader is a machine that could be developed.

MR. DALY: I have looked into all the shovels. The principle of operation would be to fill the bucket or dipper by a push movement and throw it back over itself into the car behind it.

MR. WHALEY: It is not difficult for other types of machines to meet your requirements as regards to size of drift. We have a machine now that can be operated in a drift five and a half by five and a half and has a capacity of half a ton per minute; but that machine is about 18 feet long and could not be lowered from one level to another as expeditiously as you require.

MR. DALY: You see in a lot of the metal mines there is not enough work on one level to keep the shovel busy. If the shovel were small enough that it could do its work on one level and then go down on the cage to the next and complete another job or two down there, that would be the ideal shovel. For instance, in the Butte district on the Anaconda properties, to put one shovel on each level in each mine would probably take four or five hundred. The interest on the investment would more than eat up the saving that would be made by the shovel.

MR. WHALEY: You have a very small tonnage to handle in any one place. The machine would only be working for a short time.

MR. DALY: Where the operator could take his machine to one face and load it and keep it going—that is the ideal machine that we would like.

I mentioned those conditions to let the manufacturers think it over. There is a vast field for it if you can develop it.

MR. NEEDHAM: I want to add one more thought. The machine that strikes me as having the greatest possibilities is one with some sort of a reciprocal conveyor (if you get what I mean by that); any continuous conveyor which you would have to take apart would be, I think, a failure. It would be subject to more or less strains and curves, but a reciprocating conveyor, one which moves with movable parts, to come back and get the coal and keep feeding it, would be the correct principle; but I have not been able to get anything that seemed to be practical. However, the manufacturers may work something out on it. That would give you really nothing then but a shaft, just a plunger which would

keep moving, and you could manufacture something that would stand some curvature, some inequality and would still keep itself confined to the simple trough which would be necessary to convey the coal.

MR. LEVIN: I wish to state that there are such conveyors used in England and Scotland very extensively. So that there would be no trouble to furnish conveyors of that kind if there was the demand for them. We have not had any call for anything of that kind otherwise we would have built it and we can build it at any time. There is a firm in England that makes them and another one in Glasgow. There are two or three firms in England that make that kind of equipment.

MR. COLBURN: From what has been said so far, I believe it is a little pessimistic for the underground loader, but I hope to make my remarks a little bit more optimistic. If you stop to review the field a minute, you will find in the United States today we have a number of different kinds of problems for the underground loading device. For instance, Mr. Daly has said that he wants a loader that he can take down his shaft and use in various parts of his mine. Well, I would like to tell Mr. Daly that one of the mining companies in this country is today using such a loader. He can take it down any one of the operating shafts of the Anaconda Mining Co.

We also hear that we need a loader that will transport material 100 feet. I would like to tell the gentleman that there is a loader in operation in this country today that is transporting material 200 feet.

In reviewing briefly the underground loading device bear in mind first that in some cases you have to have a loader that will handle large pieces of material; in some cases they handle rocks that are as large as a barrel; in other cases you will find that the material is very fine, and in some other cases you will find that we have to handle the material delicately. You don't want to break up the material. In some cases they like to have it broken up. Coal mines like to mine lumps instead of dust. Metal mines like to have it broken up. It saves crushing.

As a general rule, the mines of the country are not laid out to use loaders. They are laid out to use man-power. The study has been carried on in certain localities to solve certain problems. That is why we find so many different kinds of machines. To date you will find machines in use in one locality that are not talked of elsewhere. Maybe one mine has developed a machine for their own particular problem and have not put the machine on the market. The Bureau of Mines has been collecting information along this line for a considerable time and getting it in shape to give to the public. We have information about some machines that have not yet been patented. The information has been given to the Bureau confidentially and the Bureau is not at liberty to give out that information, but the two machines that I speak of are in use and are known, and I believe that there would be no objection to giving it out.

I wanted to bring out those thoughts before the subject was closed. On the market today there is the Myers-Whaley machine that is being successfully used by several mining companies that I know of. The shovel loader is also being successfully used. There is a machine invented by a Mr. Hunt that is being successfully used. There is a machine known as the John Mahin Sub-level Loader that is being successfully used.

I have seen the Marion shovels down in a mine shoveling material. The Thew is used in mines successfully. This Keystone grader that you see out in the street, that has been used by the contractors in loading dirt on a road, has been adapted to underground use and is being successfully used. In addition to this there is a scraper, which is known in some places as a "slusher," that is being successfully used.

There are some other machines that are also being used that I will not stop here to mention, but this is a big subject, a big problem and will

probably take two or three conferences of this kind to bring out all the information.

MR. NOTMAN: The thought that has occurred to me as a metal miner is this: we have been faced with somewhat the same problem as Mr. Daly has already described, and our conclusion was that if we could successfully maintain a shovel such as the shovel loader under full load, that we would make very material economies; but in a drift or cross-cut five by seven feet, it is impossible to give such a machine adequate service without delays which prevent working at capacity, and the amount of material to be handled before moving the shovel is not sufficient to show any real economy over hand labor where you can only deliver one car at a time.

The problem of the metal mines may not be so much a question of manufacturing the right kind of equipment as it is modifying their design of drifts and cross-cuts so that they can maintain adequate car service. I think that the industry itself rather than the manufacturers should investigate possible economies by widening their drifts so that they would have to break more ground but could get rid of it more cheaply.

MR. McCLOUD: I think this subject of underground loading, particularly in coal mines is of very large interest to the coal miners. The company that I am connected with has been investigating the subject of underground loading for two or three years. We have attempted to assist some in connection with improvements and developments of some of these loaders.

It seems to me that the problem of loading must be subdivided between coal loading and metal loading. I doubt if any one machine can be developed that will meet the needs and requirements of both. We know in some cases there is sufficient headroom to use the Thew shovel. We know in other cases in metal mining that it requires a small, compact machine.

In the mining of coal there are some mines in the West that can use the Thew shovel in loading. The majority of the mines, however, in bituminous work, don't have sufficient headroom to use a machine of that type. They must use a machine that has a minimum headroom. If any machine is going to be developed which is going to have a universal use, it must be produced in large quantities and at a reasonable price, because the coal mining people have small capital in many instances and have a reluctance to try out a thing of that sort.

As a result of our investigation we have figured in our mines certain limitations in regard to loaders that would be applicable to coal mining. That is, in many mines you only have three feet of headway. We feel that a machine should be able to work within three feet headway, and that it should be substantially the size and weight and price of a gathering locomotive. If you are going to run into rooms, it must not be too heavy upon your ordinary standard rails; and we feel if it is higher in price than a gathering locomotive it won't have a ready sale. In other words, the more universal demand and the greater the sales, the more money can be expended in experimental work and development.

There are many machines on the market that we have investigated, some of them in actual trial and some of them by analysis. Most of those machines will load more coal than can be ordinarily handled in cars. The limitation is not on the machine itself; it is in the matter of getting away cars from the machine. In other words, we believe that in order to utilize a loading machine to advantage, you have got to develop a system of loading, that you have probably got to arrange your mines so that you can have a series of loaders, and if that work can be systematized with a crew that is going to go ahead and do the cutting, follow up with the shot-firing, follow up with the loading and

work in rotation on a system of rooms, then you are going to utilize the machine to its full productive capacity.

The limitation is in the handling of the cars with the present system of mines. The machine must be made serviceable; it must be made simple; it must be as dustproof and foolproof as possible. It must not be complicated so that you have to take it to the blacksmith shop for repairs. An ordinary operator must be able to make ordinary repairs.

It seems to me a great deal of money might be saved and a great deal of development be made by having this matter followed up perhaps a little more persistently and thoroughly by sub-committees, subdivided so that one will investigate the conditions of loading in metal mining and the other in coal mining. If those committees make a brief digest of the characteristics and classifications and limitations of the present types of machines and make a statement or description of the average methods under which those machines must be used in the two industries, it will be of great help. No one machine is going to fill all requirements under all circumstances. It must be built for the average and adapted as nearly as possible to the other conditions.

If that were done, a considerable amount of information of an unbiased character could be gathered together, given to the manufacturers, given to the members of the Mining and Loading committee of this Congress, and I believe that it would assist very much in going ahead with the development of the machines that are necessary to meet the average conditions of loading.

If any machine can be developed we believe one that will handle 50 tons of coal a day with two men will be a paying proposition, if it does not cost too much money and the maintenance and upkeep is not too great. If you can develop a system of mining and a systematic crew which will enable it to handle 100 tons, so much the better.

If you have committees on this work, it seems to me that we ought to go ahead and continue to work along those lines. There are big possibilities in the loading. The majority of coal operators will adopt the loader if it can be made a paying proposition and if it is a machine that can be used regularly under the conditions they have to meet.

MR. A. M. CAMERON: I just want to say a word to the coal men. The coal mining industry is under condemnation at this time on account of certain statements that have been made in periodicals that have a high standing in this country. If you will look at the September Atlantic Monthly—which I think you will agree is a very high-class periodical—you will find an article in that issue about the coal business that you should read. All the Senators read the Atlantic Monthly; the Congressmen read it; the bookkeepers read it; the clerks read it; but the miners do not read it.

In that issue you will find an article by, I think, W. N. Sumps, who states that the reason for the high cost of coal to the consumer is that the coal miners and the coal operators have not developed the machinery to load the coal from the face into the cars. I don't want you to miss this, because it is a subject that is now before the public. He makes the statement that we might just as well attempt to raise the billions of bushels of wheat in our western states by turning up the soil with pick and shovel as to attempt to load 600,000,000 tons of coal a year with the present method.

He went on to state that at the present time it costs 89 cents to put a ton of coal into a mine car and with the present system of mining machinery and mining operation, production engineers have told him it could be done for 15 cents a ton.

Are we under condemnation, or are we not? I think it is a vital question, Mr. Chairman, and a broad one and a big one and I think it is probably just in the wrong place in this meeting on standardization; but if there are any machinery men here, or any production men here

who have the machinery that can load the coal for 15 cents a ton into a mine car, you can find a welcome at every mining office in the state that I hail from—Pennsylvania—and I think the same thing would be true with the metalmen.

MR. RICE: May I just say one word, because you asked me this morning to speak on this subject. You then coupled up the importance of the method of mining in connection with machines. I think the discussion this afternoon has brought that out very well, that you cannot really properly give the whole problem to the machinery man. It has been pointed out by one of the preceding speakers that it is absolutely important to be able to take care of the coal and mineral which is furnished by the machine. If that is not taken care of, the machine is not going to pay.

In the case I spoke of in these very thin beds in Scotland (and it has been tried in several mines in this country), they made the point that they must have the method such that they could bring the cars to the loading device, the conveyor in this particular case, by carrying double tracks and carrying it on beyond the point of loading, so that they can quickly switch the train of cars out.

CHAIRMAN ROBERTS: While the subject is one of vital importance, we have our regular program to complete, and therefore we can't give any further time to this subject, as much as I wish we could. However, we have accomplished what we wanted to do: and that was to show to these committees (we have such a committee both in the coal mining branch and the metal mining branch) the possibilities that lay before them.

I think the suggestion made by one of the speakers is a good one—that this Committee on Mining and Loading should be subdivided into several sectional committees. Let one committee take up the question of loading, and another take up the question of mining, etc. We could even further divide the work of the committee on loading, making a division for the problems of the Northern Illinois long wall system, and the other districts where conditions are very dissimilar, and where a machine that was developed to suit one condition would not be applicable to another at all.

MR. McCLOUD: I would like to say one more word in that respect. A decision should be reached by the committee as to whether or not it is advisable that the machine that is developed to meet the conditions should be a loading machine that actually pulls the coal down after it has been shot and is hanging there keyed up, or whether it is merely going to be a machine to load the coal after it has been spread out on the bottom. There is a divergence of opinion in that respect.

My personal opinion is that any machine that can be built within a reasonable weight and reasonable size and reasonable cost will not withstand the wear and tear of attempting to pull the coal out after it has been shot. The machine should be primarily a loading machine. It takes up too much energy and wear and tear to attempt to make it a pulling down machine as well as a loading machine.

The advantage of the committee making a report to the manufacturer is this: I have had a number of loader manufacturers come to us to get some information as to what conditions they have to meet—in one place they have one peculiar condition and the man says, "This is what you have got to meet." In another place they will go into another mine—if they get any reception at all—and there is another condition. The committee should decide and give their opinion as to what the average conditions are. In that way the machine to be developed will be universal in its use and not particular.

CHAIRMAN ROBERTS: This committee on Mining and Loading Equipment is composed almost equally of representatives from the manufacturers and representatives from the operators, and with this information before them, being a combined committee, they ought to be able

to thresh this out and give us something constructive within the next few months. They, of course, will have to meet the conditions as they find them. Mr. Needham has stated that, in the Northern Illinois field, they will be entirely satisfied with a machine that will load their coal after they put it on the conveyor, as he calls it. That would be such a help to them that they would welcome that kind of a machine. Another operator with a thick seam of coal easily loaded would not be satisfied with that. He may be a big tonnage operator and he wants to further reduce his costs. The machine that Mr. Whaley builds and is marketing will meet those conditions.

What we need is a comprehensive review of this whole subject, based on the discussion at this conference, and then a constructive report which in all probabilty will tell us that we will have to modify our mining conditions in certain instances to get the best and largest use of any loading machine. No doubt the operators will be perfectly willing to do that if we can show them that it will pay them to do so.

I think this is all the time that we can possibly take for this subject, as we have several reports to review this afternoon.

Discussion of these reports will be found on Page 135 in the Wednesday afternoon proceedings.

JOINT SESSION METAL AND COAL MINING BRANCHES

WEDNESDAY, OCTOBER 19, 1921—10:30 A. M.

COL. ROBERTS: The program, you see, states that the Chairman of this Joint Session will be Mr. Charles A. Mitke. He is in South America, and Mr. Notman, the chairman of one of his committees, will have charge of this meeting on behalf of Mr. Mitke, and I will now turn the meeting over to him. (Applause.)

CHAIRMAN NOTMAN: Our first address is on the "American Engineering Standards Committee and National Standardization," by Mr. A. A. Stevenson, President of the American Engineering Standards Committee, and also Vice-President of the Standard Steel Works Co.. In his unavoidable absence, Dr. Agnew, the Secretary of the American Engineering Standards Committee, has kindly consented to read Mr. Stevenson's address. Dr. Agnew.

DR. P. G. AGNEW: I first of all want to present Mr. Stevenson's personal regret at being unable to attend this meeting. It was hoped that the Vice-Chairman, Mr. Stone, could attend, but it was found that a previous appointment interfered.

THE AMERICAN ENGINEERING STANDARDS COMMITTEE AND NATIONAL STANDARDIZATION

By

A. A. STEVENSON, CHAIRMAN, AMERICAN ENGINEERING STANDARDS COMMITTEE

At the Standardization Conference of the American Mining Congress on November 17, 1920, the Secretary of the American Engineering Standards Committee, Dr. P. G. Agnew, outlined briefly but in a comprehensive manner, the scope of the work of the Committee, the economic and industrial significance of the work, its organization and methods, and the machinery established for international standardization. As stated by the Secretary, the American Engineering Standards Committee is solely an administrative and policy-forming body and does not concern itself with technical details, its function being to assure that each body or group concerned in a standard shall have opportunity to participate in its formulation. The actual work of preparing the standard is placed in charge of a so-called "sectional committee" made up of representatives designated by the various bodies interested, the personnel of each sectional committee being approved by the American Engineering Standards Committee as being authoritative and adequately representative of the various interests concerned.

In view of the presentation of the facts by Dr. Agnew, it seems unnecessary at this time to enter into details relating to the organization and work of the American Engineering Stand-

ards Committee, but it is believed that The American Mining Congress will be interested in learning of the developments that have taken place during the past year, with particular reference to those which affect directly or indirectly the mining industry. The fact of the matter is that I feel assured that The American Mining Congress will be interested in the developments taking place under the auspices of the American Engineering Standards Committee because I was fortunate enough to preside at the preliminary conference of the mining industry at which the subjects mentioned were discussed, which conference resulted in the formation of the General Correlating Committee for Mining Standardization; I know the efficient work that has been accomplished as a result of that conference, and the services rendered to the mining industry by those who attended. I think I will not now be violating confidence in stating that several times during the preliminary conference I felt a trifle discouraged and wondered whether or not any satisfactory results could be obtained; but subsequent developments have shown that the discouragement on my part was unwarranted. The situation which there developed and the later results bring to mind what Thomas Jefferson is reported to have said, "The things that worry us most are those that never happen."

When the address of Secretary Agnew was delivered in 1920 the American Engineering Standards Committee had approved three standards. At the present time the list of approved standards contains a total of twelve. In addition to these, fifteen existing standards have been offered for approval by the Committee which now has them under consideration.

In view of the fact that the Committee has been in existence for two years, the list of approved standards may appear extremely small. However, the chief function of the Committee has thus far been and will continue to be for some time, not so much the approval of existing standards or the creation of uniform standards as the elimination of conflicting standards. Its work to date has been concentrated more on creating organizations ("sectional committees") to determine what should be promulgated as the proper standards for the American industries, than upon selecting from the existing conflicting standards certain outstanding ones and designating them as "American." Its problems have been, and will continue to be, not technical, but human; to insure such a degree of co-operation among all organizations of each industry interested in a certain group of standards through the medium of sectional committees that they will agree in advance of the promulgation of any standards that they will adopt, as their own, such standards as are formulated by the sectional committees and approved by the American Engineering Standards Committee.

Numerous sectional committees (with personnel approved by

the American Engineering Standards Committee) are now at work upon the technical details of standards to be submitted to the sponsors and later to the American Engineering Standards Committee when approved by the sponsors. Work is now actively under way on about sixty projects which have reached an official status.

Mention should be made in this connection of certain sectional committees organized during the past twelve months, including the "Rating of Electrical Machinery," for which the American Institute of Electrical Engineers is sponsor; "Terminal Markings of Electrical Apparatus," for which the Electric Power Club is sponsor; "Pipe Flanges and Fittings," for which the American Society of Mechanical Engineers, the Heating and Piping Contractors National Association, and the Committee of Manufacturers on Standardization of Fittings and Valves are joint sponsors; "Standard of Aluminum for Conducting Purposes," for which the American Institute of Electrical Engineers is sponsor; and "Electrical Equipment on Shipboard," for which the American Institute of Electrical Engineers is sponsor. In addition to these there have been organized a number of sectional committees to deal with safety codes, the program for which has been recommended to the American Engineering Standards Committee by the National Safety Code Committee, which is acting as a general correlating committee on safety codes. As the result of recommendations made by the General Correlating Committee for Mining Standardization sectional committees are being organized to deal with "Electrical Equipment in Bituminous Coal Mines," "Portable Electric Mine Lamps," and "Storage Battery Locomotives for Use in Gaseous Mines," for each of which the Bureau of Mines will serve as sponsor.

In addition to the projects just mentioned, attention should be directed especially to a number of other projects initiated in a different manner. The American Engineering Standards Committee "Rules of Procedure" contain a section in which it is stated that upon request from a responsible organization the American Engineering Standards Committee shall, by a conference of the bodies interested, determine the desirability of undertaking the development of the proposed standard, and if the development seems desirable, may designate a sponsor, or sponsors, for the work. During the past twelve months as the result of such conferences, ten organizations—the American Electric Railway Association, American Institute of Electrical Engineers, American Railway Engineering Association, American Society for Testing Materials, Associated Manufacturers of Electrical Supplies, Association of Edison Illuminating Companies, Association of Railway Electrical Engineers, National Electrical Light Association, National Fire Protection Association, and Underwriters' Laboratories, have been designated as joint sponsors for "Unification of Specifications for Insulated Wires and

Cables"; and the American Institute of Architects, the American Institute of Electrical Engineers, and the American Society of Mechanical Engineers have been designated as joint sponsors for elevator standards; and the American Institute of Architects, the American Institute of Electrical Engineers, and the National Association of Electrical Contractors and Dealers have been designated as joint sponsors for "Symbols for Electrical Equipment of Buildings and Ships"; and the Bureau of Standards and the Society of Automotive Engineers have been designated as joint sponsors for a Safety Code for Aeronautics. The American Railway Engineering Association and the U. S. Forest Service have requested that the American Engineering Standards Committee call a conference on Railroad Tie Specifications, which will be held on October 25, 1921; and the Association of Edison Illuminating Companies has requested the calling of a conference of interested bodies to determine whether the unification of definitions, symbols and abbreviations, especially in electrical literature, should be undertaken.

Experience has proved that the conference method of initiating the unification of standards possesses many advantageous features, while its disadvantages practically do not exist. When men get together in a conference of this kind and interchange ideas concerning the proposed unification in standardization, they obtain a comprehensive view of the whole field; harmony emerges from discord, and differences disappear in agreement. Incidentally they obtain a better understanding of the function of the American Engineering Standards Committee and a more perfect appreciation of the results it is aiming to accomplish.

From the international viewpoint the American Engineering Standards Committee is recognized as being the one organization qualified to speak for national standardization in America. It was represented as a conference of the secretaries of the national standardizing bodies in London in April, 1921, called by the secretary of the British Engineering Standards Association. The conference had for its object an interchange of experience and the furtherance of co-operation between the various national bodies in their work of industrial and engineering standardization.

It is interesting that, notwithstanding great differences in the details of procedure, the same general method of work is followed in the different countries, namely, technical decisions concerning any specific piece of work are in the hands of a working committee which is so constituted as to be broadly representative, from both the technical and the managerial points of view, of the particular branch of the national industry concerned. This same general method is followed whether the work is of the nature of specifications, methods of test, or dimensional standardization.

The secretaries have submitted the suggestions of the confer-

ence to their respective organizations, many of which, including the American Engineering Standards Committee, have already voted their approval. These suggestions dealt with the interchange of publications, a reciprocal arrangement for making foreign standards available to the industries of each country through their sale by the offices of the national bodies, the exchange of information as to the status of work in progress, and other methods of furthering co-operation between the national bodies.

As chairman of the Committee I feel that our secretary's trip to Europe to establish personal contact with similar organizations in other countries and learn of their methods has been of exceptional value not only to the Committee but to the numerous industries in this country. I consider his report on Industrial Standardization in Germany of such value to the industries of America as more than to cover the whole cost of his trip.

Developments during the two years of its existence have shown the desirability of making certain changes in the Constitution and Rules of Procedure of the American Engineering Standards Committee, but I am thoroughly convinced that basically its methods are sound and must result in the production of standards that are truly American. This fact is appreciated not only by the organizations actively co-operating in the work, but by certain other groups that have adopted in its essential details our method of doing business. Incidentally, some of our own member-bodies have altered their methods of producing standards so as to conform to the procedure of the American Engineering Standards Committee.

Not by the number of standards produced, but rather by its success in bringing about industry-wide co-operation in the unification of standards, must the American Engineering Standards Committee be judged.

CHAIRMAN NOTMAN: Gentlemen, you have heard Mr. Stevenson's very interesting address as read by Dr. Agnew. I think it might be well for all of us who are on Committees of The American Mining Congress on Standardization to take a leaf out of their book in our methods of procedure, and also not to be too discouraged when we don't succeed in promulgating a standard every five minutes. If we get one or two each year, I feel that we will be accomplishing a great deal.

Some of our sessions have so far, perhaps, not developed anything more than the fact that we ourselves didn't know what we wanted in the way of standards and were not standardized at home, so to speak. I think standardization, like charity, begins at home.

We are going to work Dr. Agnew overtime this morning, and unless there are some comments or discussions of Mr. Stevenson's paper, we will proceed.

COL. ROBERTS: I just wanted to add a few words of explanation that some of the gentlemen present will more thoroughly understand what the American Engineering Standards Committee is. It is the national clearing house for standardization in the United States. All national organizations interested in standardization in any industry, if they want to make their work national in scope, must affiliate themselves with the American Engineering Standards Committee, and most of the national organizations that are doing active standardization work are

affiliated with the American Engineering Standards Committee, as you can find by taking their Year Book and finding the bodies that are connected either directly or as associates in that work.

They have two kinds of membership—the active membership, those who belong to the committee and are directing its work and have voting members on the committee; and those who are associated with the committee. At the present time The American Mining Congress is an associate member. That is, we are clearing through them, but we are not an active member and have no vote in adopting their standards or in passing upon standards that are put up to them for approval.

However, we are actively associated with them through the general correlating committee, which is the national organization for the mining industry and is a subsidiary committee under the American Engineering Standards Committee, and we are an active member of that general correlating committee.

I just wanted you to understand that so you would appreciate the importance of these two addresses—the one that Dr. Agnew has read on behalf of the President of the American Engineering Standards Committee and the one which he will now read as Secretary of the American Engineering Standards Committee.

CHAIRMAN NOTMAN: Is there any other discussion of the paper of Mr. Stevenson's, or of Col. Roberts' explanation of our relations to this committee? If not, we will call on Dr. Agnew. (Applause.)

INDUSTRIAL STANDARDIZATION IN EUROPE

DR. P. G. AGNEW, SECRETARY

AMERICAN ENGINEERING STANDARDS COMMITTEE

It is the purpose of the present paper to present some notes on particular phases of industrial standardization in Europe, rather than to treat the subject adequately or in true perspective. The point of view is that of standardization along national lines, that is in national industries as a whole, the work being carried out through a national standardizing body rather than by individual companies or by technical or industrial associations, without the participation of all interested bodies.

There are now twelve national standardizing bodies in Europe. As might be expected from the industrial importance of the two countries which are our chief competitors, the British and the German bodies are in a class by themselves in the extent and importance of their work. Yet very active and significant work is being done in Austria, Belgium, France, Holland, Sweden, and Switzerland. The national bodies of Czecho-Slovakia, Italy, Norway and Poland have been organized only recently. Outside Europe, there are national bodies in Canada, Japan and the United States.

CHARACTERISTICS OF CONTINENTAL WORK

Looked at broadly, the continental work shows interesting differences in principle from that in Anglo-Saxon countries. With exceptions, such as must always be made in general statements of the kind, the latter have taken much more to such matters as specifications for materials and for performance of apparatus,

methods of test, and other matters having to do with purchase and contract, than have the continental countries. On the other hand, the continental countries have developed dimensional work much further than has been the case in English-speaking countries. (The work in the automobile industry in America is an outstanding exception.) This dimensional work includes not merely the interchangeability of supplies and of machine elements, but also the inter-working of parts and of related apparatus made by different manufacturers, and interchangeability, so far as the users are concerned, of complete machines and apparatus.

The Anglo-Saxon and the continental work differ in another important way. Fundamental theoretical considerations appear to weigh much more, and immediate commercial considerations and exigencies to weigh less with the continental than with the Anglo-Saxon type of mind. As in their politics, the latter pursue an opportunist policy, each project being taken up whenever there is a request from industry for it, and the relations of each project to other work being settled from opportunist considerations. Each piece of work thus becomes a block in an unplanned mosaic. The continentals, on the other hand, are much more apt to place before their working committees a carefully-planned outline of a whole subject, on the theory that in carrying out each piece of work consideration should be given to how it may be made to fit into a planned mosaic, however much the plan of the mosaic must be changed during the carrying out of the work. Both these tendencies are, I believe, slightly more accentuated in the British work than in the American work, while in the Belgian work, the opposite tendencies are less accentuated than elsewhere on the continent.

GREAT BRITAIN

Naturally, the British work is better known in America than is that of any other country. Nearly 150 standards have been adopted and published, many of them having gone through several editions. Most of them deal with specifications for materials along lines somewhat similar to the work of the American Society for Testing Materials, and as in the latter, specifications for metals play an important role. There are a few dimensional standards, the most important of which is that on sections for structural steel.

The work has been a most important factor in the development of British industry. Their manufacturers attach great importance to the role which the specifications have played in the foreign trade situation, and still more to the role which it is planned that they shall play in the future. Recently a large fund was raised to translate those specifications which are best adapted to the purpose into French, Spanish, Portugese and Italian, and to distribute them in strategic foreign centers. The British govern-

ment contributed £10,000 to this fund. Twelve "local committees" have been formed in such countries as Argentine, Brazil, China, Spain, etc., to further this work. These local committees work in close co-operation with the British consulates.

FRANCE

The French national body is organized under the government Ministry of Commerce and Industry. Plans have been made for systematic work in fourteen industries. Over fifty standards have been published in final or in tentative form. The French Chamber of Commerce is taking an active interest in the work. The working committees are made up on the representational plan, the leading industrial and technical bodies participating in the work.

BELGIUM: Several standards have been issued by the Belgian Association. In technical content the work is apt to follow much the same lines as French practice, on account of industrial and linguistic relationships, and the use of the metric system, though commercial intercourse with England has a marked effect. The Association is supported by the national association of manufacturers, the leading technical bodies, and the government.

HOLLAND: The work in Holland is very active. About fifty standards have been issued. They are largely dimensional in character. As in the case of Belgium and Switzerland, the country is not large enough to form an independent industrial unit, and this fact has a profound influence on the standardization work. Holland's chief industrial relationships are with Great Britain and Germany.

SWITZERLAND: Next to the British and German, the Swiss and the Dutch work is the most active and extensive. In one respect the Swiss work is unique. Swiss manufacturing industries depend almost exclusively upon export. As practically all the manufactures, except the watch industry, is in German-speaking Switzerland, the standardization work is necessarily very closely related to that of Germany. It is, as yet, nearly all dimensional. It is supported entirely by the Swiss Manufacturers' Association. Over thirty approved standards have been issued.

GERMANY: The German work is peculiarly interesting on account of its importance and its activity, and also on account of a similarity in the conditions, at the time the work was organized on a national scale, to those in America. Germany is one of the three leading industrial countries. The industries of Austria, Holland, Sweden and Switzerland, are so intimately related to those of Germany on account of geographical and other relation-

ships, that they are necessarily affected very largely by developments in Germany.

Prior to 1917 there had been a vast amount of standardization work carried out by individual companies, and by engineering societies and industrial associations, but it had not been unified along national lines. The central body (the Normenausschuse der Deutschen Industrie) was organized in 1917 at the suggestion of the German government, by the German Society of Engineers. The leading technical and industrial bodies of Germany are now associated with the Society in maintaining it. The organization and methods are similar to those in other countries. The detailed technical work is in the hands of what in Anglo-Saxon countries would be called "sectional committees," i. e., committees made up of representatives of all bodies interested in the particular subject in hand.

The central body handles only those matters which are of common interest to two or more industries. By far the greater part is dimensional. Great attention is being paid to supplies and machine elements such as screw-threads, bolts and nuts, standard diameters, fits, and systems of limit gaging. About 150 standards and 500 officially proposed standards have been issued. They are published in loose-leaf form, a method followed by the Austrian, Dutch, Swedish and Swiss.

The work has become so extensive that in order to keep the various industries in touch with the various phases of it, a periodical publication has been established, in which official proposals, news of the standardization movement, etc., are published. It appears semi-monthly, averages 16 quarto pages, and has a circulation of 8,000 copies. The sale of standard sheets reaches some 100,000 monthly. Firms purchase them in quantity, and put them into the hands of their technical staffs as working drawings and data sheets.

This refers to the work of the central body only. In addition, there are some fifteen organizations, known as "special industry committees," each of which deals with the standardization work peculiar to a single industry. They are affiliated with the central body.

The volume of work being carried out through these special industry committees appears to be at least as great as that under the direct control of the central body.

It has sometimes been stated that the continental work is too theoretical and accordingly does not get into actual use. In the work of the four continental bodies with which I am most familiar, Belgium, Germany, Holland and Switzerland, I have learned nothing to justify such a criticism. The work seems to be woven very intimately into the industrial fabric. In fact, in many instances, it goes much further than would be possible in England or America. For example, complete purchase specifications are now in universal use for distributing transformers, in-

cluding even maximum and minimum limits of efficiency. Similar specifications for certain classes of motors include regulation, efficiency, power factor, and air gap. In some cases motors of all German manufacturers are both mechanically and electrically interchangeable This has been true of motors for mine pumps for several years, and is said to have been of great importance in keeping mines in operation during the war. It has led mine operators to exert pressure to secure complete interchangeability in other kinds of machinery.

It is interesting to note, in connection with the last point, that in both the British and the German work, the impetus toward standardization usually comes from the users, and that its effectiveness generally depends upon their being organized.

There seems to be a striking analogy between the present standardization movement in Germany, and the research movement started there a generation ago. Whatever estimate one may place upon the role it played in German industries generally, everyone agrees that research was fundamental in the development of their great chemical industries. The role which the Germans are expecting standardization to play in all their industries would be not unlike the role which research has played in the development of their chemical industries.

Unquestionably the German industries are planning and are carrying out a far-reaching program of standardization as a necessary step in building up an unprecedented industrial structure which must rest in large measure on an extensive foreign trade.

EXAMPLES OF GERMAN WORK: As typical examples of the German work, their system of "preferred numbers" and their standard series of handles may be mentioned. The first is a fundamental piece of work, founded on theoretical considerations and of the first importance. It is a simple system of numbers for use in all new standardization work, in which graduated numerical values are required, such as standard gradated diameters of pulleys, thicknesses of plates, or capacities of machines. The numbers increase logarithmically (but rounded to even convenient values) so that each differs from the next by a given percentage. If it is decided, for example, that in a graduated series of plates 5 steps in thickness between 10 and 100 millimeters are desirable, then the "5-series" would be used, viz.: 10, 16, 25, 40, 64, 100 mm. For 10 steps, the "10-series" would be used, viz.: 10, 12.5, 16, 20, 25, 32, 40, 50, 64, 80, 100 mm. There are a "20-series" and a "40-series" for still finer steps. For a range from 1 to 10, the decimal point is merely shifted, etc. The Germans believe that the use of these numbers is going to lead to great economies in material, in reducing the number of sizes, ranges, etc., simplify the carrying of stocks, facilitate interchangeability. It may be shown theoretically that, under average conditions, a given number of standard sizes laid out according to these numbers, will be better fitted to any series of jobs taken at random,

than would be the same number of sizes laid out in any other way, and this with a minimum of material.

The standard handles furnish a typical example of German love of thoroughness of detail. There are two shapes, each adapted to a particular method of use, and there is a series of sizes for each shape, laid out according to the preferred number system. The profiles have been worked out with the most extreme care, an efficiency engineer having been employed to make time-motion studies to determine the exact profile that would insure the greatest accuracy in operation with the minimum fatigue of the workman's hand. It is held that by doing a thorough job once for all, different industries and firms will be saved from doing the same thing over and over, but always less well, and that at the same time interchangeability is introduced.

INFORMATION ON FOREIGN WORK: As a result of a conference of the secretaries of national standardizing bodies held in April of this year, arrangements are being completed for a systematic interchange of information between the national bodies as to the status of their various projects. Each will also act as a sales agent for the publications of the other bodies. Thus, through the American Engineering Standards Committee, copies of foreign standards and specifications are readily available to our industries.

CHAIRMAN NOTMAN: I am sure that we have all enjoyed Dr. Agnew's very interesting and stimulating description of Europeon progress in standardization. If there are any questions that any of you would like to ask Dr. Agnew, I am sure he will be ready to answer them at this time.

MAJOR WARD: May I ask the Doctor to explain the standard sheets so largely used in Germany?

DR. AGNEW: The German standards are printed on loose-leaf sheets, a little bit bigger than our standard 8½x11 page. One of these pages, for example, will contain the data for screw threads between two different diameters or for a whole range. Another sheet will contain all of the data on one of these that I have just described. Another will give data on another line. Where standards are too long to put on one or two sheets of paper, they are subdivided.

CHAIRMAN NOTMAN: Are there any other questions?

I personally was very much interested in what Dr. Agnew had to say about requiring the users of special designs to pay for the extra expense of manufacturing. In our own Committee on Drilling Machines we have run into the fact, as told us by the manufacturers, that we don't know what we want as users, and consequently the expense of manufacturing has been tremendously increased by the infinite number of designs that we ask for; and if we are going to make any progress in standardization, why we have got to get together on what kind of equipment we want to use and not allow the individual to run riot with his particular petty ideas.

I presume that all of us have been paying for the experiments demanded by the other fellow as well as our own.

Are there any other questions that you would like to ask Dr. Agnew?

COL. ROBERTS: The object in preparing this carefully arranged program on national and international standardization was to bring to this body not only certain information regarding national and inter-

national standardization, but to bring to you the inspiration that comes from the large work that is being done and of which we are now a part.

It has occurred to me, since Dr. Agnew has answered the last question, to suggest to our Standardization Conference that we might learn a great deal if we would get in closer communication with Dr. Agnew, representing national and international standardization, and when any of our committees have not been able to reach conclusions regarding certain matters, as just suggested by Mr. Notman in connection with his committee which has a very difficult subject to handle, they might learn from the experience of those who have been at this work for many years something that would enable them to reach a conclusion and possibly satisfactory conclusion to the manufacturers. I am particularly impressed with the simple arrangement adopted by the Germans for trying to standardize motors. We have in this country many sizes of motors. Certain of those sizes are used a great deal more than others and when the government was trying to select a few sizes of motors that would be adopted as standard, so that the manufacturers could increase production, we didn't use such simple methods as that, and I don't believe anything like so efficient, believing absolutely in the statements made by Dr. Agnew that those are not just theoretical sizes but they are mathematically correct within those two limits—ten and one hundred.

If we had had this information at that time, it would have saved our committee many hours of labor and we would have possibly arrived at absolutely mathematically correct results whereas ours were by the eliminating method. We eliminated the motors that we thought they could get along without, and finally settled on certain horsepowers that we thought were essential. However, this is a much more positive way of arriving at results than by the method of elimination.

That all impresses me with the importance of this particular program that we have prepared for you and how much we can learn from it. I believe in the future if the chairmen of our committees, whenever they run into difficulties that they seem unable to solve, will get into communication with Dr. Agnew, he may be able to furnish you with information that will make your path very much smoother and easier.

CHAIRMAN NOTMAN: Is there anything further?

MR. ILLSLEY: I was impressed with the statement that the man who buys the standard device has to pay for the special device ordered by some one else. It seems to me that that could be used as a slogan for standardization—equity for the buyer.

CHAIRMAN NOTMAN: Are there any further questions, gentlemen?

If not, we will proceed to the next paper on the program—"Government Interest in Standardization for Mining Industry." This paper has been prepared by Prof. E. A. Holbrook, Assistant Director of the U. S. Bureau of Mines. In Prof. Holbrook's unavoidable absence, we are going to call on Mr. O. P. Hood, Chief Mechanical Engineer of the Bureau of Mines, to read Dr. Holbrook's paper.

MR. O. P. HOOD: Mr. Holbrook regrets very much that he could not be here at this meeting, but the exigencies of the work of Assistant Director made it impossible for him to come.

GOVERNMENT INTEREST IN STANDARDIZATION FOR MINING INDUSTRY

By PROFESSOR E. A. HOLBROOK, ASSISTANT DIRECTOR, BUREAU OF MINES, WASHINGTON, D. C.

Government interest in standardization for the mining industry, as expressed in major part through the Bureau of Mines,

is the belief that standardization will be a real help to the mining industry, both from economic and safety viewpoints, and since the main purpose of the Bureau is to promote a better mining industry, it becomes plain why the Bureau should in every possible way foster and assist all interests who are working for standardization and better economic and safer practices.

The true meaning of standardization is as little understood as the true meaning of the word "theory," and yet the two have much in common. Theory is a digest of accumulated experience; a safe starting plane on which to base new practice by providing the background of accumulated experience. In the same way standardization, the universal adoption of the best, is practice based on a digest of accumulated experience. A safe and workable basis on which to carry out the best practice.

For the development of better theories research and investigation is needed. Likewise, if standardization is to be truly representative, some body of men must investigate the unusual and little known factors and prepare data on the fundamentals of the subject before a real standard can be built up. This research is not necessarily a laboratory investigation. Your Mining Congress, through its technical subcommittees is as truly doing research and investigational work as is a chemist buried in his laboratory. By bringing out and sorting the accumulated experience of their membership, the committees are laying the only real basis on which standardization can be built.

In many phases of the work you find that past practice has fairly covered the desired field and it is necessary only to use the combined judgment of the members to pick out and recommend from this material, the best. For example, in choosing proper track gauges. In other cases you or any body engaged in standardization will find that there is in existence insufficient knowledge on which to base a standard. For example, you would not today standardize practice in rock drills without stating that the acceptable drill should in operation produce a minimum of dust which might be injurious to the health of the miner. And yet who today could give you any definite data on the character, amount and size of the dust which an acceptable rock drill could or should make? Such an investigation would require considerable money, time and independent supervision. A single manufacturer or a single mining company would not be justified as commercial concerns in making such an investigation as the returns to themselves would not warrant it; your committees themselves are perhaps not closely enough organized or sufficiently equipped to carry out such a detailed work, and yet from a country-wide standpoint the value of the investigation both from health and standardization viewpoints over the course of a few years, would be well on the right side of the ledger.

It is in investigations of this sort that the Government Bureau should take a leading interest, first as a disinterested body capable of serving men, companies and societies that represent the industry; second, as an agency justified in expending considerable sums of money on investigations of such scope that the single private body can not justify itself in doing; third, as a closely knit and continuing body in universal touch with the industry; fourth, as the organization best equipped with necessary workshops and experimental apparatus, and, fifth, as having an organization of trained engineers and investigators whom prime interest and capabilities lean strongly to research and investigating rather than to the commercial and operating side. I know of investigative engineers who have made contributions of real value to the profession who have not been successful as operating men. Likewise, many successful operating engineers have neither the time or inclination to undertake fundamental experimental work.

The function of the Bureau in standardization, then, is to work in fundamentals. Today it is doing this in several ways. First, by suggestion and initiation from its own force of men. These engineers, standing out of close range of the details of the operating end and visiting many plants, are often able to anticipate the desires and needs of the industry in investigation, and the Bureau undertakes the work on its own responsibility. Second, by co-operation with an outside agency. If an outside agency, as a state, or society, or individual, suggests an investigation which the Bureau can undertake it welcomes the work. Often limitation of funds and the immediate value of the work causes the outside agency to furnish part or all of the funds for the investigation. Thus last year there were in effect over forty such agreements, involving expenditures on the part of the co-operating agencies of nearly one-half million of dollars. A very considerable part of this work had a direct bearing on standardization and its accompanying necessary knowledge based on proven facts.

And how best can the Bureau "put across" this work to the industry? By publication and by personal contact with the industry. It is a necessary part of every co-operative agreement that the Bureau shall have the right to publish the results. They are not copyrighted and should be and are free for use in any and every way by the individual, the company or society.

Where the work has been of a nature that the results naturally express themselves as a possible standard, the Bureau has been glad to propose it as such, hoping in this way to easiest, quickest and in the most representative manner, obtain the full criticism of all interests. Where the investigations, in whole or in part, have appeared to fit into and assist in the standardiza-

tion or code work being done by the various state mining departments, the Associated Companies, the Mining Congress and the National Safety Council and others, we have felt satisfied that the work has been worth while. Also the intercourse which our men have directly and personally with the various interests of the industry, as contact in the mines, assistance to manufacturers serving the industry and work with organizations and committees helps to "put across" our efforts.

I believe that standardization is less advanced in the mining industry today than in almost any other branch of engineering with which the American Engineering Standards Committee is functioning, and that in none other is there greater need or a wider field. For example, the other branches have told us that standards in ventilation and in ladders were ripe and ready to pick. Yet what a lot of things we need to learn and sort yet in these branches as applied to the mining industry. In these and in other desirable lines the Bureau hopes to do fundamental and continuous research work. We expect you and the other co-operating bodies to take interest in, to criticize, and if possible to use the work in the interests of better practice and in helping to reduce mining, through standardization to a truly engineering practice.

CHAIRMAN NOTMAN: Is there any discussion of Prof. Holbrook's paper?

MR. DALY: I was particularly interested in the paper just read. A portion of it particularly referred to my home place. I think it was about 1916 that the condition in the mines in the Butte District in Montana, from the standpoint of dust, had gradually grown into a very serious condition.

We didn't realize it, as the gentleman has said; we didn't have time to devote our interest to that as much as to the operation. At about that time we organized a Safety First and Welfare Department to enter into work of that kind.

I would like to say, on behalf of the Anaconda Mining Co. and the other companies operating there, that too much praise cannot be given to the Bureau of Mines for the assistance that they gave us and in which they went ahead independently of us, making investigation as to the causes leading up to silicosis. As you all know, underground mining has a tendency to leave the lungs in the particular condition from dust and other causes that make them more susceptible to tuberculosis, but in addition to the tuberculosis part, the silicosis is the big item in the underground mining today.

The investigation was conducted by Dr. A. J. Lanza and Mr. Harrington. They spent two or three years in the Butte District. We gave them every co-operation that we could because we knew their work was going to bring about good results. As they have proceeded from month to month and year to year they kept us in touch with the determinations that they had been making. It brought us to a point where we knew something had to be done and it was at that time that I demanded from the drill companies that they had to produce a successfully operated water drill.

It was really the demand, I believe, from the operators in the Butte District that first forced the Bureau of Manufacturers to devote considerable time and money and energy toward developing this so-called

water stoper. Prior to that time there had been some water stopers developed but they were not satisfactory.

In conditions where the mines are dry and particularly where silica dust is breathed into the lungs, it is never breathed or coughed out. It is much different from the other particles of dust on account of the angular form and the very sharp corners that it has.

I can say to all the operators that when the people from the Bureau of Mines come to make an investigation of that kind that if they are given the most hearty co-operation, very good results will be obtained.

MR. RICE: That touches very close home to me, because that investigation is one that I have had to do with since it was first taken up by the Bureau of Mines in the Joplin District preceding the investigations at Butte.

The thought I was going to bring up was the difficulty, sometimes, of trying to make standards. We are up against that proposition from trying to make up our minds now as to what should be the criterion in judging the performance of rock drills from the standpoint of health, because while the water drill has made an enormous gain, there comes a cry from South Africa, from their silicosis investigations there, whereby they actually condemn this equipment. I recently saw where one of our best known American drills was condemned because it was not sufficiently satisfactory in laying the finest dust.

However, the problem as it comes to the Bureau at present, it seems to us is not perhaps from the mechanical end, because the standardization of dust production is going to vary manifestly with all the different kinds of rock you have, with the different kinds of steel that you may use—hardness, sharpness and all that sort of thing.

As to the effect on health, our physiologists have not been able to tell us just what is the dangerous amount of dust in the air. The South African Commission, which has had the advantage of being able to closely carry on the health standards and to make autopsies and examinations of men, considered that two dust particles, two microns in diameter finer than that only were a dangerous kind, fine enough to get into the cells of the lungs and ultimately cause the lungs to fill and harden.

However, we in this country are as yet hampered with the fact that we cannot get statistical data based on thorough medical examinations. Unfortunately the state of Arizona, for example, has passed laws which prevent examination in connection with mines. For that reason our investigations there have been hampered so that it is very difficult as yet for us to get the starting point of what constitutes a dangerous dust.

All we can proceed on at the present time is that most all dust containing quartz particles is dangerous dust, but it is a long way, I am afraid, before we can make standards for dust performance with machines. However, it is a long time investigation and we are going to try to keep at it until we get somewhere.

MR. DALY: I may add, too, supplementing my remarks about the water machine, that while that allayed the dust from the drilling, it did not do away with the dust from the other part of the mine; but if it had not been for this investigation that had been made by the Bureau of Mines, I don't believe that we would have brought water through every drift, cross-cut raise and stope in our mines. However, now that we have brought about the water stoper and have introduced it generally, we have to have water connections to those drills, and therefore without any additional expense we spray all of our drifts and cross-cuts, our rock drills and stopes and shoots, and the like of that, wherever the dust demands or requires it.

So the investigation has brought about a condition whereby the number of cases of silicosis will be very materially reduced by that method of operation.

MR. C. S. HURTER: If you wet down the piles of muck immediately after blasting, you reduce the amount of bad fumes arising from them that sometimes affect the matter.

CHAIRMAN NOTMAN: Are there any other remarks?

I don't care to take issue with Mr. Rice, but as an Arizona operator I feel I should come to the rescue of the state in a way. We were threatened with such legislation, but through a fortunate combination of circumstances we avoided it. You might be interested to know that a number of the mining companies in the state, including my own connection at Bisbee, have had physical examination for a number of years past and are still doing it in spite of threats.

MR. RICE: I am very glad to hear it.

CHAIRMAN NOTMAN: Are there any other questions or remarks? If not we will then proceed with the paper on the "U. S. Bureau of Standards and Standardization," and I will again have to call on Colonel Roberts for an explanation as to this paper.

COLONEL ROBERTS: Gentlemen, we had fully expected that Dr. Stratton would either arrive in time from Europe to deliver this address or that Dr. Burgess would recover from his present illness and be able to deliver it. We have been disappointed in both. I will, however, make just a few remarks regarding the work of the Bureau of Standards. I am sufficiently familiar with the work of the Bureau and its co-operation with all other work on standardization to say just a few words.

The Bureau of Standards, under Dr. Stratton's efficient leadership and with his splendid staff and his wonderful facilities, has been of very great help to every organization, industrial or otherwise, that needed detailed, minute and careful investigations on any particular phase of their work. For instance, during the war (and I guess it was carried on before that) we were carrying on a very extensive work on standardization. Dr. Stratton practically turned over his organization during several months to other governmental departments that were carrying on that standardization work.

For instance, we were directing that work through our committees along very similar lines to the work that is being carried on by The American Mining Congress—in other words, The American Mining Congress set up was made from the experience we got in standardization work for the government during the war.

We had many very important investigations to make; as stated by one of our speakers, the data at hand was not sufficient from which to establish standards, and data had to be prepared before we could establish standards. Then we called upon the Bureau of Standards to make those careful, detailed investigations at their laboratories and prepare specifications for us that would then be considered by our committees, the usual procedure having been that we would take the specifications furnished by the various corps and divisions of the War Department and by a process of combination and elimination we would prepare specifications, but very often we had no adequate specification and no one on any of our committees wanted to take the responsibility of trying to prepare such specifications, so there were careful investigations made by a good staff with good laboratories to prepare this information for the committees.

We found Dr. Stratton and his institution at our service at all times in that work and he has assured us since in carrying on this program for standardization for the mining industry that whenever we had problems of that character that our committees wanted assistance on, we could refer them to him and they would very gladly assist us in any way they could.

That, mind you, is along certain lines of laboratory investigations. The Bureau of Mines does the same thing for us in a very much bigger and broader way because they are the direct representatives of the min-

ing industry for the government, and they are closely associated with us in this work of standardization of the mining industry and carrying on at the present time many important investigations on specific lines of work that fit in to our larger program.

That is the way the work of the Bureau of Mines, of The American Mining Congress, and of any other national organization that is trying to do something to improve the method and practices and standardize for the mining industry, is co-ordinated.

I will go into this subject more in detail in an address that I will make on Thursday afternoon on the work of Co-ordination of Standardization for the Mining Industry, but for fear some of you might get away and miss that, I wanted you to know what important factors the Bureau of Standards and the Bureau of Mines are in carrying forward any program of standardization for the mining industry.

Note.—Discussion on Mining and Loading Machines occupied the balance of the morning. Reports of proceedings transferred to page 679. Tuesday morning session.

The meeting then adjourned at 12:15 p. m.

JOINT SESSION OF THE COAL AND METAL MINING BRANCHES

WEDNESDAY, OCTOBER 19, 1921—2:30 P. M.

The joint session of the Metal Mining Branch and the Coal Mining Branch of the Standardization Division convened at 2:30, Col. Warren R. Roberts presiding.

Note.—The first part of this meeting was taken up with a discussion on Mining and Loading Machines, which will be found in Tuesday afternoon's record, page 106.

CHAIRMAN ROBERTS: The only work that we have to do to complete this session is to review the reports which have now been presented to this Joint Conference from the two branches. We have the reports from the Coal Mining Branch and the reports submitted by Mr. McGrath of the Metal Mining Branch. I would like to have Mr. McGrath come up and preside with me to help handle the reports from the Metal Mining Branch.

(Mr. McGrath was not present.)

MR. NOTMAN: I would suggest you appoint Mr. Daly as he presided at most of these meetings.

CHAIRMAN ROBERTS: Mr. Daly, will you come up and assist me in handling the reports from the Metal Branch?

(Mr. Daly then took his seat by the Chairman.)

You will please understand, gentlemen, that now, meeting in joint session, we are going to receive the reports that have been carefully considered by each branch in separate session. We have several excellent reports here from the Coal Mining Branch which were read before that branch, carefully discussed and have since been revised by the committees that submitted them. Now those revised reports are ready for submission to this Conference for disposal, either for their approval or their further criticism.

Mr. Daly has the reports of the Metal Mining Branch and we will first take those under consideration.

MR. DALY: I regret very much to state that the progress made by the Metal Mining Branch has not been sufficient to bring about a final report upon any of the sub-committee matters excepting one. As you know, the Coal Mining Branch began functioning a couple of years ahead of the Metal Mining Branch, and although committees were appointed a year ago covering the different subjects, they have not had sufficient time up to the present to finish any of these matters.

For that reason in all of the sub-committee matters in the Metal Mining Branch, only progress reports have been submitted, and at this time I regret to say that none of the progress reports are far enough advanced in order to even enter into Joint Conference with the Coal Mining Branch. I do not believe, Colonel Roberts, that the progress has been sufficient to even attempt to enter into a joint discussion and I don't know of anything further that the Metal Mining Branch could add at this time.

It is our desire that progress during the coming year will be pushed ahead with much more rapidity, and that at the next Joint Conference some definite action might be had. I was appointed a member of the Committee of Four, two from the Metal Mining Branch and two from the Coal Mining Branch, to discuss the matter of correlating three of the sub-committees. Our committee met and discussed the matter yes-

terday but we had to conclude that nothing could be done at this time.

I don't know of anything further that could be added on behalf of the Metal Mining Branch.

CHAIRMAN ROBERTS: I would like to inquire, Mr. Daly, what the method of procedure would be then with your reports? Would you suggest that your progress reports should be included in our Standardization Bulletin as a matter of information for the industry, with the understanding that immediately following this conference the reports that have been submitted by the various committees, together with a digest of the discussion, carefully briefed following each report, be printed in our "Standardization Bulletin" which we hope to have out in December?

MR. DALY: Yes, a majority of the committee reports are in such shape, and I think it would be advisable to publish them as a matter of information.

If we follow out the method of procedure that was adopted unanimously at our afternoon session yesterday, the industry would be invited to critically study your reports, including the discussions and reply to your Chairman, making further suggestions for the completion of those reports.

MR. DALY: I think that would be ideal.

CHAIRMAN ROBERTS: Then, if that is agreeable to the Conference, that will be the method that will be followed in receiving and publishing those reports together with the discussion. If that meets with the approval of the conference it will be so ordered. Is there any discussion on that subject? If not, we will consider that that is satisfactory to the Conference and the reports of the Metal Mining Branch will be so handled.

MR. DALY: I believe that Mr. Mitke desires to participate in the briefing.

CHAIRMAN ROBERTS: Yes, certainly. These discussions will be mailed to Mr. Mitke, and with the assistance of his Committee, they will be edited by them for the "Bulletin."

MR. DALY: That will be fine.

CHAIRMAN ROBERTS: Then, we are ready to take up the reports of the Coal Mining Branch. Our first report is the Committee on Mine Ventilation. This report was read before the Conference and has since been carefully revised by the Committee and is signed by the Chairman, Mr. Montgomery, and nine members of the Committee. I do not believe it is necessary for us to read this report again as the Committee have simply revised it so far as the suggestions brought out in the discussion seemed advisable to the Committee.

They now offer this report, with those revisions, ready for the approval of the Conference and later to be published in the "Standardization Bulletin" and sent out to the industry.

What shall we do with this report?

COLONEL MILLIKEN: I move that it be accepted, published and sent to the industry.

(The motion was seconded by Mr. Pauly.)

CHAIRMAN ROBERTS: Is there any discussion?

MR. RICE: What does that mean, Mr. Chairman? Does that mean the final expression of the Mining Congress, or is that in a sense something which is put up as a tentative standard for future consideration by the industry?

CHAIRMAN ROBERTS: I would answer your question, Mr. Rice, by quoting the decision reached yesterday as to the method of procedure. These reports were to be printed together with a brief of the discussions that would enable any one who was reading the report to obtain the criticism and suggestions that were offered to that report (and there has been a very full expression in the Conference on the report) and that would enable those who received the "Bulletin" in the

industry to not only read the report and see what the Committee has recommended, but the expression of the conference regarding that report. They are not offered as a standard. They are sent out as the best that we have been able to produce up to date as suggestions for improved methods and practices on standardization. Does that answer your question?

MR. RICE: Yes, except that I can well understand that as it might reach out into the industry, there might be some very valuable suggestions received that possibly might have been overlooked by the smaller committee. Again there may be changes in opinion as time goes on, requiring revision.

I was wondering if it was considered in any sense a permanent standard or whether it would be put up to see if any modifications could be made in it. I do not feel that anything can be made in the way of a standard, except on the dimension, that can be made in any sense permanent.

CHAIRMAN ROBERTS: If you had been present at the reading of these reports, Mr. Rice, you would understand that the recommendations made by our Committees are very largely on approved practices and methods, to gain a greater economy in operation and greater safety, and that thus far we have not gone (in most of our reports) into the details of equipment, although some of the committees have. In submitting this to the industry, if any operator or any operating official is sufficiently impressed with the value of our suggestions, he certainly will adopt them and make use of them; and if he is co-operating with us to the extent we hope he will, and there is anything in our recommendations that he thinks he can improve upon, he will show us the courtesy of replying and making his suggestions. Those will come in to The American Mining Congress at Washington and will be sent to the Chairman of the General Committee who will carefully consider them and send them to the chairmen of the committee of the subject that is under consideration, together with any suggestions that the chairman of the General Committee has to make, after reading the criticism.

Then that Committee will take those suggestions and criticisms under further consideration, preparatory to issuing their report for the coming year. At the same time those committees will be going on into a new field of usefulness in their line pending the receiving of the replies to their previous report, if they have any further work to pursue.

Some of our Committees feel that they have gone as far as they care to until they get an expression from the industry. Other committees may feel that they have further work to do that they can be doing pending the expression from the industry.

Does that answer your question?

MR. RICE: Yes. I regret very much that I was not here when the matter came up for discussion, but I thought, on questions like ventilation, that you might readily touch on possibly some of the standards that might be set by the different states, or even in the case of the Federal government on leased lands—standards such as the limitations in the amount of impurity which might be present in the air.

CHAIRMAN ROBERTS: Is the Chairman of this Committee, Mr. Montgomery, present?

(Mr. Montgomery was present.)

I cannot recall all of your report, Mr. Montgomery, sufficiently to answer Mr. Rice on that question, and I would like very much to answer it through you as to whether your report goes into details of that character that would, in all probability, find any conflicts in the laws of the states or of the Federal government?

MR. MONTGOMERY: I do not think it does, Mr. Chairman. In compiling that report we looked forward to the main principle, that is to the efficient and economical ventilation of mines, and we did not in-

clude any recommendations that we thought would conflict with any of the laws of the different states.

CHAIRMAN ROBERTS: I might answer Mr. Rice, further, by saying on behalf of this Committee that I would consider that this report on Mine Ventilation constituted what I would call the minimum requirements for a properly ventilated mine.

Does that now answer your question, Mr. Rice?

MR. RICE: Yes.

CHAIRMAN ROBERTS: Are there any further questions before we proceed to vote on the motion before the house?

(The motion that the report of the Committee on Mine Ventilation be accepted and published for the industry was put by the Chairman and was carried.)

CHAIRMAN ROBERTS: Our next report is the one on Mine Drainage. All that I have said about the report on Mine Ventilation applies equally to this one on Mine Drainage. The Committee has carefully avoided going into the details of the equipment for proper drainage of a mine, only so far as to lay down the general rules that would apply to equipment to economically drain a mine, and they have subdivided their subject into several different methods of draining a mine to meet various requirements.

I consider it a most excellent report, and I think the adoption of it by this Conference and the recommendation of it to the industry will go a long way toward improving mine drainage. It is really an excellent treatise on the proper drainage of a mine, whether it be a drift, a shaft, or a slope mine.

What shall we do with this report, gentlemen?

MR. PAULY: I move it be accepted.

(The motion was seconded.)

CHAIRMAN ROBERTS: This report is signed by the Chairman and three members of the Committee who are now present.

Is there any discussion of this report?

(There being no further discussion, the motion was then put by the Chairman, and carried.)

The next report is one by the Committee on Underground Transportation. Mr. Watts, the Chairman of this Committee, is not present, but he is well represented by the members of his Committee and three sub-committees. This report, as I advised you at our previous session consists of a very brief general report presenting the reports of the three sub-committees—one on Mine Locomotives; one on Coal Mine Cars; one on Mine Tracks and Signals. These are all very fine reports, very complete in many details, and while I could not pass upon these reports personally as well as I could on the two previous ones, as many of the subjects were unfamiliar to me, it appeared to me to be a very excellent report. This report by the Sub-Committee on Mine Tracks and Signals is accompanied by a detailed diagram of frogs, turnouts and switches and is a most complete and valuable report.

I think any mine superintendent or competent mining engineer could take this report and properly lay out his tracks for any of the track gauges or other requirements that have been covered by the report.

The report by the Sub-Committee on Mine Locomotives is briefer, as this sub-committee has not gotten into the subject so far; but my recommendation would be that the reports be accepted and printed with a request that these sub-committees continue the good work that they are doing.

What is your pleasure in the matter?

MR. KUDLICH: I move that the reports be accepted.

(The motion was seconded by Mr. Pauly.)

CHAIRMAN ROBERTS: It has been moved and seconded that the report of the Committee on Underground Transportation, together

with the reports of the three sub-committees be received and disposed of as ordered by the previous motion.

(The motion was carried.)

I neglected to say that these reports are all properly signed not only by the Chairman of the General Committee, but the chairmen of the sub-committees.

The next report is on Outside Coal Handling Equipment. It is signed by Dr. Payne, Chairman. Mr. Needham, I handed you the original copy of this report and since you were not present when it was read, but have been very active on the work of this Committee I would like to know if you have any suggestions or additions to make to this report before we accept it?

MR. NEEDHAM: I think not.

CHAIRMAN ROBERTS: This report, of course, will be published if so ordered, together with the transcript of the discussion at the Conference. What shall we do with this report?

COLONEL MILLIKEN: I move that it be accepted.

(The motion was seconded, was duly put by the Chairman and was carried.)

CHAIRMAN ROBERTS: That makes five valuable reports from seven of our committees.

We have two more committees, one on Underground Power Transmission, of which Mr. Kiser is Chairman; and one on Power Equipment, of which Mr. Pauly is Chairman. Mr. Pauly advised you yesterday quite fully as to why they had not offered any further report. The fact is that the two committees, acting jointly, had rendered so complete a report last year that they did not consider they had anything further to do at the present time until they had received the replies from the industry to which the report had been very fully distributed.

We are now ready to receive the report from the Special Joint Committeed appointed on Monday to consider certain suggestions made by your chairman at that session. Colonel Milliken, I believe you have your report ready for the Conference.

COLONEL MILLIKEN: Yes, our report is ready.

REPORT OF SPECIAL JOINT COMMITTEE OF THE TWO BRANCHES

The joint committee consisting of two members from each, the Metal and Coal Branches, of the Standardization Conference—appointed to consider the advisability or practicability of combining the committees of these branches where the subjects seem to be identical—and to review the reports that have been presented and discussed, have given careful consideration to these subjects. They are unanimous in the opinion, first, that the time is not yet ripe to attempt the consolidation of any of the Committees. It is thought that each Branch is making progress in its own way, that because of the wide divergence in operating condition in the Branches, the fact that the two Branches operate largely in separate districts of this large country and because at the present time the majority of reports are ones of progress—better results will be obtained by continuing the present organization.

The Committee feels that at a later date there may be some consolidations that will be of value. They appreciate that in the near future recommendations may be made by one Branch

that can consistently be adopted by the other. They appreciate, too, that in the near future the two Branches may make recommendations for like operations that may be conflicting.

They, therefore, recommend the appointment of a Standing Joint Committee whose duty it shall be to review the reports of the several Committees before being finally presented to the Congress in order that conflicting recommendations may be avoided.

If this recommendation meets with the approval of the Joint session of the Standardization Conference, they further recommend that Committees forward their reports to their respective Chairman—three months in advance of the date of the Annual Meeting in order that the Joint Committee may have sufficient time to digest and to make their definite recommendations.

This Committee feel that when reports have been discussed on the floor of the Convention, that the Chairman of the several committees are in better position to make final recommendations than for this Committee or a Standing Committee to attempt.

Respectfully submitted,

J. MILLIKEN,
E. D. KNIGHT
W. B. DALY
ARTHUR NOTMAN

CHAIRMAN ROBERTS: The members of the Metal Mining Branch have agreed to this report?

COLONEL MILLIKEN: Yes, they have all signed it.

CHAIRMAN ROBERTS: Mr. Milliken, your committee has done splendidly. Gentlemen, you have heard the report. What shall we do with it?

MR. HOOD: I move that it be accepted.

(The motion was seconded.)

CHAIRMAN ROBERTS: You have heard the motion. Is there any further discussion of the matter?

(The motion to accept the report of the Special Joint Committee was put by the Chairman and was carried.)

CHAIRMAN ROBERTS: That disposes of this question so far as this particular phase of it is concerned.

Now we should take up the recommendations of the Committee that a permanent Joint Committee should be appointed to carry on along the lines suggested for this Temporary Committee. I think it is an excellent suggestion to have a permanent Joint Committee to coordinate our work.

After a considerable discussion of the subject it was decided by the Conference to adopt the recommendation of the temporary Special Joint Committee that a permanent Joint Committee be appointed to carry on this work of co-ordinating the reports from the two branches of the Standardization Division.

It was also decided that having adopted the report, including the recommendation of the temporary Committee, that the Chair-

man had authority to appoint a permanent Committee. Whereupon he appointed on behalf of the Coal Mining Branch, Messrs. Col. J. Milliken, E. D. Knight and K. A. Pauly.

The representatives of the Metal Mining Branch, after a Conference, appointed Messrs. W. B. Daly, Arthur Notman and Chas. A. Mitke.

CHAIRMAN ROBERTS: I wish to bring to your attention again the method of procedure which was mentioned in my report at the first session of our Conference. After our reports have been fully approved by the Standardization Division and we have these completed reports ready to offer to the industry, what shall be our method of procedure?

(The Chairman then outlined again briefly the method of procedure for the adoption of our reports, as follows: when we have completed any particular work, like the final adopted report of one of our Committees and consider that this is ready for the industry and want to make it a standard, then we submit this report to the General Correlating Committee with sufficient copies of it to enable them to send a copy to each member of their Committee. Such bodies as are not interested in the subject so advise and any member body that is interested in the subject can then require the appointment of a sectional Committee on which Committee there shall be representation from all member bodies who are interested in the subject. At the same time each representative on the General Correlating Committee must advise whether his society is interested in the whole or a part of the work under consideration. If interested in all of the work then his society becomes a joint sponsor on the Joint Sectional Committee and if interested in only part of the work his society becomes only an associate in the preparation of the completed report for an American Standard.

When this Sectional Committee has completed its work on this subject then it reports back to the General Correlating Committee. If any changes have been made by this Sectional Committee in the report as submitted by the member body originating the report, then the report must be sent back to that body for final consideration and approval of the changes made in the revised report. In this manner it is then finally sent up to the General Correlating Committee as a recommended standard and this Committee in turn so recommends it to the American Engineering Standards Committee.)

After a very considerable discussion of the subject the Conference decided to adopt this method of procedure. A motion was made by Mr. Pauly, duly seconded and unanimously carried by the Conference that this method of procedure should be adopted and that a joint Publicity Committee should be appointed of two representatives from each Branch of the Standardization Division to assist in carrying out this method of procedure and otherwise promoting publicity of the work of the Standardization Division.

At a later Conference with the members of the Coal Mining Branch, the Chairman appointed as representatives of this Branch, Messrs. Ralph C. Becker, C. H. Trik and the representatives of the Metal Mining Branch appointed Messrs. Chas. F. Willis and T. O. McGrath as representatives of this Branch.

That completes the program for the afternoon. If there are any suggestions, however, from the Conference, I should like very much to have them.

MR. KUDLICH: On behalf of the Resolutions Committee I have a resolution to present. It is offered by Mr. Milliken.

(Mr. Kudlich read the resolution.)

CHAIRMAN ROBERTS: I would like to inquire from the author of this resolution if it was intended that this resolution should be a request for such a procedure at our next conference, it being too late now to carry such a resolution into effect?

COLONEL MILLIKEN: For succeeding conferences.

CHAIRMAN ROBERTS: Your recommendation is that this method of information for the members and guests of the Standardized Conference should be carried out at the next conference?

COLONEL MILLIKEN: Yes, sir.

MR. BELL: Mr. Chairman, I am a member of the American Chemical Society and at our convention recently in New York City, we published every day about noon a list of the members that had registered, their occupations and home addresses and also where they were stopping in New York City. There was more eagerness shown in getting copies of this Registration List than anything at the convention.

COLONEL MILLIKEN: I might say a word in explanation. I too belong to several organizations that have meetings where they publish such a bulletin. My first thought in coming to a convention is that I want to know who is here, whether some of my friends are here, whether members of committees are here. With such a bulletin you can very readily find whether or not they are here and locate them.

It is very cumbersome to get this information from the Registration Office. I think it is something that would be very much appreciated if put into effect.

MR. MONTGOMERY: I move you that we adopt this resolution.

(The motion was seconded.)

(The motion to adopt the resolution was then put by the Chairman and was carried.)

CHAIRMAN ROBERTS: Mr. Kudlich will offer this resolution to the Chairman of the Resolutions Committee of the Convention.

That reminds me, gentlemen, that I have not appointed a Publicity Committee. I have been so taken up with other duties that I forgot that you authorized me to appoint a Publicity Committee and I have given no thought to it. I will have to confer with representatives of the Metal Mining Branch before we appoint that Committee. Therefore I am sorry that I can not announce that Committee, but I will announce it at a later session.

We have only completed now the routine work in connection with our reports. We have not completed the work of our Conference. I will just remind you of the important matters and sessions that are still on our program.

(The Chairman made announcements concerning the program.)

COLONEL MILLIKEN: Before we adjourn I would like to say a word about our Chairman. I wonder if very many of us realize the tremendous amount of work that the Chairman of a convention of this kind is called upon to do. Our Chairman has not only seen to the appointment of all committees, but he has followed up the work of the individual committees. He has received their reports, he has handled

all of the work in connection with the Standardization Conferences here in Chicago, and I think not only for the Coal Section but very largely for the Mining Section, in the absence of Mr. Mitke.

It has all been done wonderfully well and I would like to suggest that we stand up and give a rising vote of thanks for the very efficient and courteous way in which our Chairman has performed his duties.

(The members arose and applauded, indicating unanimous approval of the suggestion made by Mr. Milliken.)

CHAIRMAN ROBERTS: I thank you very kindly. It has been a pleasure as well as an honor to serve you, and I only have one request to make, and that is that you shall urge upon The American Mining Congress that they engage somebody to do part of this work for me. I am willing to direct it but I cannot do the amount of work that I have had to do the last six months, and we are going to make a request upon the management of The American Mining Congress that they shall secure someone who shall be the direct and active head of the Standardization Division which is the largest division in The American Mining Congress.

I thank you very much, gentlemen.

The meeting then adjourned at 4:25 P. M.

ADJOURNMENT.

JOINT SESSION OF THE COAL AND METAL MINING BRANCHES

THURSDAY, OCTOBER 20, 1921—2:45 P. M.

The Joint Session of the Metal Mining Branch and Coal Mining Branch of the Standardization Division convened at 2:45 P. M., Col. Warren R. Roberts presiding.

CHAIRMAN ROBERTS: According to the program of the Standardization Conference we were to have held this session at 2:30 this afternoon in this room. I think if there is anything that is discouraging and almost disgusting it is to work for weeks to prepare a fine program, invite men of national reputation, busy men, to spare their time to come to this city and deliver addresses, and then the members of the convention have many other things to do at the time those addresses are to be delivered.

We started in at one of our sessions yesterday with only about this many people and before our program was through we had 100 or so who strolled in. I have done the best I could to try to get an audience for our speakers. I am offering this as my alibi. There are so many attractions in this city that the men who come in from outside of the city are everywhere except attending this session to hear these addresses, and I apologize to the speakers who have gone to the trouble and expense and have sacrificed their time to come and deliver addresses and find that we have no audience for them.

Our first address this afternoon is on Safety and Standards. That is just a brief statement of the purport of the address. Mr. S. J. Williams, the Chief Engineer of the National Safety Council, will advise you as to the exact nature of his address and we have very great honor in introducing Mr. Williams to speak on Safety and Standards. Mr. Williams. (Applause.)

SAFETY AND STANDARDS

By

MR. S. J. WILLIAMS, CHIEF ENGINEER, NATIONAL SAFETY COUNCIL, CHICAGO, ILL.

Mr. Chairman, I think that was a pretty neat alibi to give to a Chicagoan, to say that the glories of this city, to which I, as a resident must of course assent, are such as to attract the multitudes away from the otherwise facinating eloquence that they have an opportunity to listen to here this afternoon.

Alibis, however, are not necessary, Mr. Chairman, because I know the high quality of the standardization work of The American Mining Congress that you gentlemen are engaged in; and it is quality that we want more than quantity.

You have heard yesterday of the importance of standardization work in the mining industry from various points of view and I don't think I have to touch on that side of it or duplicate any of the persuasive arguments and reasons that were undoubtedly set forth as to why this work should go on.

Obviously any sort of standardization is of interest and value in accident prevention, because when you bring about some measure of uniformity in equipment or operating methods, whether directly concerned with safety or not, you correspondingly decrease the opportunity for misunderstanding and ignorance of those methods on the part of new men, which we know is such a frequent cause of accidents in the case of men changing from one place of employment to another.

With respect to standards that directly affect accidents prevention—in other words, uniformity in regulations which are themselves for the purpose of safety—it is equally obvious that where we have a lot of conflicting jurisdictions, or a lot of conflicting standards on the part of adjoining states, that we have a corresponding lot of grief and trouble and often expense for the companies that are operating under those different jurisdictions.

So what few observations I have to offer here this afternoon are going to be concerned more with how we get the job done. I think we all who are here agree that it has got to be done, and if I have anything at all to contribute, it will be along the line of how it can be done successfully.

It occurs to me that the job of standardization is a two-fold job—one part engineering, the other part diplomatic work. Speaking as an engineer, with at least my fair share of pride in the profession, I say honestly that the diplomatic part of the job is a good deal bigger than the engineering part, because no matter how good a standard we may formulate, it is not worth the paper it is written on unless it is going to be used, and if half a dozen or a dozen of the finest engineers in the country get together in a room and formulate a standard that is absolutely perfect, a dozen other men, whether operators or politicians or even the rank and file mine prospectors off in some state, can absolutely nullify the work done by the engineers because they can prevent the standards from being practically put into effect.

There is no use in building a great edifice of engineering skill unless we have first the broad foundation, and that foundation I thoroughly believe must be a foundation of democratic consent and approval of the job. You, Mr. Chairman, thoroughly recognize that fact. I have often heard you refer to the necessity of selling this whole proposition to the industry, to the mining industry in this case and The American Mining Congress has recognized the necessity of proceeding in that way.

Not only must it be so to the industry but it must be so outside the industry. It must be so to governmental authorities. It must be so to insurance authorities. It must be so to the rank and file of people that have an influence in one way or another on legislation that is to be enacted in the various states in which these standards are to be crystallized.

A few years ago we used to say, "Well, democracy is a good thing in a way but if you really want to get anything done, the autocratic way is the one" and we used to point for proof to the achievements of nations that we looked upon as autocratic. We don't hear so much of that the last couple of years. Germany was efficient in the first few months of the war but the German efficiency of autocracy broke down in the last years of the war because it was not founded on popular consent and you will pardon me for reiterating it, but I feel so very strongly that that is the basis that we must have for this sort of work.

So, as I was saying, The American Mining Congress has recognized the breadth that we must have by not only making standardization as democratic as possible within the ranks of The American Mining Congress, but by voluntarily tying it up through the medium of the American Engineering Standards Committee with similar organizations everywhere in all lines of industry that are working toward the same end.

I go further than that. The democracy of standardization must be the very extreme of democracy. It must be a round table democracy, where there is hardly any perceptible leadership. For example, let me refer to the movement that is now pretty well under way for the standardization in safety codes generally, in all industries. Two or three years ago it became evident that there was a widespread demand for uniformity in safety legislation, both governmental and insurance, and yet as people got together and talked about it, it became evident that there was a very widespread objection to permitting that very necessary movement to be headed up in any one place by any one organization, whether a governmental department or a semi-private association, and the National Safety Council, although having possibly the broadest general interest of any one organization, made no effort to take leadership in the movement but rather said, "We will be glad to come in as one of you and form a round table group in which every one of us comes in on an equal basis."

There is all the difference in the world, gentlemen, between saying, "My organization has a Committee and we would like very much to have you come in and advise that Committee and we will take it and give careful consideration to your suggestions," and saying, "Gentlemen, let's form a Joint Committee and let's all get together and work this thing out."

I have seen examples of that in standardization efforts in other fields besides mining, where people, coming together with the best intentions in the world, trying to have their own particular organization head up some movement, and inviting others to come in and advise and then to go home again and let the Executive Committee of the first organization determine where they have absolutely failed in that effort, because the men

called in, whether they were big or little in the eyes of the world, were in their own eyes just as big as the people that called them, and they didn't propose to come in and be heard and then go out and have somebody else decide.

We can't do it that way. I don't know of another example as good, at least none better in practical affairs, than the essential soundness of the injunction, "He that would be first among you, let him be the servant of all." Leadership in this standardization work, gentlemen, whether leadership of organizations or of individual men is going to come to the organization or to the man who makes the least pretention to leadership.

I have just one other observation to make, with respect now more to the content, to the form of the standard itself. I don't suppose anybody ever started a job of standardization of any sort without running up against the question of whether the standards should be general or specific. I have seen that fought over at least for the last eight or ten years in which I have been interested in the subject in one capacity or another, and it is one of those questions that is never going to be settled.

Everybody starts out to make a standard with the firm determination that he is going to confine himself to broad general principles and everybody equally, when they get on to the job, find themselves immediately involved in a mass of detail. There is no happy solution to that, but I think there are one or two principles that may be observed.

One is by all means to make the standard, wherever possible a standard of performance rather than a specification of method. One can't always do that and the practical answer is that where a specification of method or a specification of the exact equipment to be used is necessary, always to couple it with the statement that another method or other equipment, giving equal safety or equal results, whatever the desired results may be in the judgment of the authorities, shall be equally acceptable.

Anything else makes you wide open to the immediate criticism that you are stifling development of the art which, of course, if that criticism is justified, is absolutely deadly to the progress and the popular acceptance of the results of your standardization.

I believe that every standard which is either intended to be enacted into law or which if not so intended may be taken by some ultra-progressive or ultra-zealous legislative body and enacted into law, should begin with a carefully framed paragraph which will permit the substitution of equivalent methods or devices which, after proper examination and proper safeguards by the authorities having jurisdiction, may be found to give equal results to that specified.

It is obvious that that throws you at once into the question

of whether you can trust your inspecting and enforcing authorities. That, gentlemen, is a question you can't get away from. If your enforcing authorities are incompetent or dishonest, your standard is no good anyway whether it is general or specific.

I believe—and I speak on this point as having been for five years in charge of a governmental administrative department that was up against these things—that you will get further if you practically give your administrative authorities power, not to let down the bars, but to accept the equivalent methods or equipment; that then you increase the possibility of having a wise and fair administration of your laws.

You can't give a man responsibility without authority and if you give him both authority and responsibility, then you can hold him for results, and if the people of your state, or whatever the jurisdiction may be, know that that is the sort of responsibility that your administrative authorities have, why there is that much more chance that the people of your state will demand good authorities.

Then finally, if as a corollary to this, it is necessary to leave your standards elastic to permit development of the art, to permit the use of equivalent methods or devices to where they will be economical, why then, that, of course, obviously implies that you have got to have some continuing central body, committee or whatever you may call it to guide the development of your standards along those lines of elasticity.

Take, for example, the Boiler Code that you are all familiar with: my impression is that the Boiler Code Committee thought, when the code was done, that the committee was going to disband. On the contrary, I think the committee's work is now almost greater in volume than it was in the beginning, because with the constant interpretations of the boiler code on the part of inspectors of all shades of authority, both in governmental and insurance fields, making interpretations and referring back to the committee, or asking the committee to make interpretations for them or other people complaining to the committee that wrong interpretations have been made.

Therefore your standardization body must be a living, continuing thing, and that is all the more reason why it should be organized on a sufficiently democratic basis so that it will command general respect.

That, gentlemen, in my humble opinion, is the general path along which this work must go, if it is going to be successful. If it does go along that path, with absolute forgetfulness of selfish interests on the part of either individuals or organizations, with a single desire for service, I believe that it is going to be one of the biggest movements of the kind that American industry has seen and that if the men in the organizations take

part in it unselfishly, they are going to be recognized in later years as having made a very big contribution. (Applause.)

CHAIRMAN ROBERTS: We are going to have time this afternoon for discussion of each paper as read, and if at this time you have any questions to ask Mr. Williams, or any suggestions to make regarding his address, or any questions that arise in your mind from having heard his address, we would now be glad to hear from you. We would like very frank and free discussion of each one of these papers. That is one of the benefits that come from having an address read in the Conference.

Have you any questions to ask, Dr. Agnew?

DR. AGNEW: No.

CHAIRMAN ROBERTS: There was one thing that occurred to me while I was listening to Mr. Williams, that I think would be of interest to the Standardization Division. We had been hoping that we would develop this work for The American Mining Congress to a state where they would be justified in having such a man as Mr. Williams in connection with the work of the National Safety Council. This is an old organization that has been doing splendid work in a national way in promoting and directing the work of safety in all of the industries in the United States.

Our work, of course, is applied to a single industry. Their work covers all industries, but they have sufficiently developed that work that they can afford to have a man like Mr. Williams, who is their Chief Engineer and Secretary, and I am living in the hope that the time is not far away when The American Mining Congress can have a man devote to this work, as the work is of sufficient importance to have some able man give his entire time to directing this work and helping to promote it in the industry.

I neglected to announce, before calling on the first speaker, the general subject, but it is in your program and you have all no doubt noticed it. The general subject for discussion this afternoon is the "Commercial View of Standardization," as against a very different subject that we discussed yesterday forenoon. In other words, these addresses and speeches were carefully selected to cover that general subject of the commercial view of standardization. It is a session jointly by the two branches of the Standardization Division, and Mr. McGrath, sitting beside me, is the representative of Mr. Mitke, the head of the Metal Mining Branch.

Now we will have our second address on "Standardizing Research Results Through Public Information," by Mr. C. R. Thomas, Editor of the Professional Engineer. Mr. Thomas. (Applause.)

MR. C. R. THOMAS: Mr. Chairman and Members of the Conference: When the Chairman apologized for the size of the audience, it occurred to me that John Wesley was converted in a meeting much smaller than this, and if we can have one more John Wesley for the standardization movement out of this meeting I think it will be a wonderful success—we already have one John Wesley in Colonel Roberts. (Applause.)

When your Chairman asked me to speak on the subject of Public Information and the Relation between Research and Standardization, he didn't know that he was asking me to talk about my hobby. I am a courtier in the court of His Majesty the Public; and if you do not believe that the public is "His Majesty" just take a whirl at it.

STANDARDIZING RESEARCH RESULTS THROUGH PUBLIC INFORMATION

By C. R. THOMAS*

Research and standardization are apparently at opposite poles; the one seeks to discover the new, the other seeks to stay put. And yet there must be some common ground. For standardization without research leads to stagnation and research alone would lead to greatly reduced production of many products which are universally needed at a low cost. I believe that no common ground for research and standardization can be obtained except through a mutual and intimate knowledge of aims and accomplishments. This knowledge must be thorough and instant. In the machinery of modern business the press, and particularly the scientific press, is a most useful medium of education and the exchange of ideas. For while the press may tend to retard standardization by continually noting new developments, it also prevents mistakes that might prove disastrous in a new business.

The press is limited for constructive work by the lack of balance which exists between research and standardization information. There is a natural tendency on the part of men engaged in research work to be reticent in giving out ideas and accomplishments connected with their work. On the other hand, the principles of standardization are widely recognized as desirable for adoption and have been discussed in the press. The standardization problem is largely one of getting men to agree upon a method of procedure, and following this method of procedure to a logical and universal conclusion. And so lack of balance is, I believe, the greatest obstacle in the way of standardization at the present time.

The development of a proper balance between research information and the standardization of methods, materials, or machines is so interwoven with the vari-colored cloth of business that it would be a hardy man indeed to attempt to say just when research results should be standardized in production methods. Using a glittering and almost useless generality, it might be said: The quicker the better, if one is sure of his ground; but it is easy to make mistakes.

Research may be arbitrarily divided into scientific or altruistic research, conducted largely by educational institutions which seek solely to add to our store of knowledge, and industrial research, generally the result of private enterprise, which seeks to improve products so that the owners may benefit. So-called statistical or business research may seek to add to the store of

*Editor, "Professional Engineer," and in charge of Public Information, American Association of Engineers. Formerly in charge Review and Publication of Results, U. S. Forest Products Laboratory.

knowledge or it may be for private gain. Dr. C. E. K. Mees, the head of the Eastman Research Laboratory, says that the results from research are so indeterminate in the beginning that a distinction can be only as to intent. Of the three types of research I believe that business or statistical research is perhaps the greatest aid to standardization. For by determining and tabulating just how many and where existing methods and ideas have a common ground, standardization is furthered.

The General Electric Company, which has been developed largely through the stabilizing of research results, illustrates how private research may be organized. This organization may be roughly divided into a research unit, a development unit, and a production unit. In the development unit research ideas are tried out and methods determined which are later put into effect commercially in the production unit. In this way costly mistakes are avoided and full advantage is taken of the development of new ideas.

Research results obtained by private enterprise are not available to the press to the extent that results obtained by government research organizations or universities are made public. The reason for this is obvious and needs no discussion. A workman is entitled to the reward from his work, and for this reason we have patent laws—even though sometimes patent laws are inadequate and the workman does not get his due reward. On the other hand, research methods have developed in the past decade so that many manufacturers find little protection in the secrecy of their ideas and they must depend largely on the effectiveness of their productive and distributive organization to make their business profitable. If this is true, much greater publicity can be given to research results by private individuals; and they would profit more thereby. On the further development of the idea hangs to the greater usefulness of the press as an aid to standardization.

It is an interesting fact that the centers of many great industries are at the place where advanced methods were first used in that industry. The rubber industry is centered in Ohio, the automobile industry in Detroit, the optical glass industry in Jena, and there are many other examples. The reason seems to be that there were men with the tested information that would permit standardization for quantity production, and hence profitable manufacturing. This industrial concentration would probably have not existed to any such extent had the press been utilized as fully as might have been profitable to the industry as a whole and most certainly to the people, who use the manufactured products of that industry.

Admitting the advisability of utilizing the press to present the results of research work in an informational way for the immediate use of those who are seeking to standardize for quantity production and therefore economy, let us consider how the press

has been utilized by some organizations in this country. The Government departments are a great medium of research and standardization. There we find research work in progress, statistical research to the nth power, and the fullest publicity through the press given to all results—although I have known two years to elapse between the time a manuscript was sent to the Government Printing Office and the date of its appearance in print.

Consider the Bureau of Standards, which is in reality an immense research organization. If fullest publicity is not given to results obtained there we have a paradox—a union of two extremes. But the paradox is avoided by means of publicity. Dr. Stratton, the able director of this organization, understands well the delicate relations that exist between standardization and research, and the value of public information in maintaining a proper balance between the two. Standardization results that he has been able to achieve have been largely due to the speed with which research information has been made public. Mr. C. P. Winslow, director of the Forest Products Laboratory, where I formerly worked on the review and publication of results, believes firmly in the value of public information as an aid in standardization of research results, to the end that production costs may be reduced and thereby greater general prosperity brought about. I believe that publicity was the basic idea that made possible the great work of Dr. Holmes in developing the Bureau of Mines and effecting economies in the mining industry through standardization. The Bureau of Mines is another immense research organization and Dr. Bain has followed a comprehensive plan of public information. The rapid standardization of the use of concrete by the Portland Cement Association is a most excellent example of what can be accomplished by a private business through public information. In this case, private enterprise deliberately established a publicity organization which is also, by the way, a very effective research organization to popularize—another word for standardize—the use of a material. I believe you will admit that it has been a most successful venture both from a business standpoint and from the standpoint of making everyone familiar with a useful material.

The mining industries have to do with the production of raw materials and it is an economic fact that raw materials are affected first by a decline in public demand for manufactured products. Standardization of demand is of much greater importance to the mining industry than the standardization of the methods of mining. In the standardization of demand a policy of public information can be followed to a much greater extent than it has been used in the past.

I believe that engineers as a whole have not realized the importance of public information. One of the objects of the American Association of Engineers, with which I am connected, is to

popularize public relations among engineers. Manufacturers, on the other hand, appreciate the friendship of the public.

But you may ask "How shall I as an engineer, or a producer, or a manufacturer, utilize the press in aiding standardization? Scientific and trade organizations," you may say, "publish the results of their work and we have a technical press already too voluminous to be read."

The machinery for public information undoubtedly exists, but is it working to capacity, and has standardization been effected in the methods of getting information to the press, and do these standardized methods function properly? From my experience as a technical editor I am inclined to think that they do not function properly. It is exceedingly difficult to get a scientific man to present an idea to the public through the press until it has been so thoroughly developed that he is absolutely sure of it. This procedure is perhaps correct from the standpoint of the scientists but from the standpoint of the interested manufacturer or man who must standardize upon the results that are obtained and who may be planning to standardize on methods which have been in vogue for some time but which new development may make obsolete, knowledge of possibilities is frequently as valuable as knowledge of actual accomplishments. Moreover, the great consuming public may not take kindly to the new idea. Public opinion is exceedingly wilful and frequently it does not respond to new ideas as quickly as scientists and manufacturers estimate. It takes a long time to popularize a new idea and it is well to be forehanded and start early. Standardization is based upon popularity and follows well in the rear of new development. While it requires courage and vision for a manufacturer to standardize his equipment for the production of a new product, if he guesses right he receives a great reward.

I believe that industries should organize bureaus for public information about research and standardization. The chemical industry has realized the importance of this work; the effective work of the American Chemical Society is well known to most of you. Editors are only too anxious to receive information as to new developments in an industry and improvements in old methods which lead to standardization. Technical editors as a class are men of judgment and honor and they would not knowingly publish anything that would react to the discredit of any engineer with constructive ideas, or any organization that is seeking to advance the industry and to better economic conditions in the country. You can trust the editors of the technical press to a much greater extent than they have been trusted in the past.

A technical editor told me recently that he obtained an authoritative account of a failure of a large structure, and when this account was submitted to the owners of the structure they demurred at having it published. It was only after the editor had

sent a hundred-word telegram (which he said was more effective than he expected) in which he recounted the dangers of having the account of the failure garbled by reporters who were not fully acquainted with the facts, that permission was obtained to publish the details. The reticence on the part of the owners was perhaps pardonable and it is to their credit that they had the vision to see that the country as a whole would benefit by not maintaining secrecy in the affair.

Again we have the familiar case of the inventor who has a wonderful idea and who will not impart it to even a patent attorney. His idea is of no benefit to himself or anyone else. Again we have the trade organization with its secrecy and fear of competition—a falacious idea which proves profitable in very few instances. For competition is the life of business. The more people in a business the more business there is. Newspapers which are our daily record of affairs can be used effectively to standardize ideas and methods. The people as a whole are always interested in new developments which affect their pocketbook and health.

The detailed discussion of the methods employed in public information work is beyond the scope of this paper. But the numerous avenues of public information available through organized effort are indicated in Table 1.

A typical functional organization for a public information bureau using all methods of publicity is shown in Figure 2. A similar organization for institutions of a public or charitable nature in which people are so interested that it is seldom necessary to buy advertising space to obtain publicity is shown in Figure 3. Figure 1 shows the varied appeals possible.

Summing up, it is believed the mining industry can profit by the use of the press in popularizing research and standardization information. Standardization makes for lower production cost, and with low cost comes greater use, for it is a law of economics that when costs increase substitutes are used. Moreover, with intimate knowledge on the part of the public will come the hearty support of the public. Public support is a valuable asset and an economic force that cannot be neglected with impunity.

TABLE 1. PUBLIC INFORMATION MEDIUMS

(Omitting Magazine and Direct-by-Mail Advertising)

NEWSPAPERS AND MAGAZINES

1. News items relating to specific happenings or accomplishments.
2. Photographs with short descriptive captions.
3. Editorials.
4. Cartoons of any kind.
5. Interviews with prominent people.
6. Sunday feature articles.
7. Special column comment: (a) humorous, (b) sporting, (c) women's, (d) society.

8. Letters to the editor and answers.
9. Feature stories for magazines.
10. Technical articles for trade magazines.
11. House organ articles and comment.
12. News syndicate photographs.
13. Picture syndicate photographs.
14. Contests: Limericks, jingles, definitions, letters, songs, photographs, posters, essays, slogans.
15. Slogan campaigns such as "Concrete for Permanence."

THE SPOKEN WORD

1. Addresses by prominent men which are reported.
2. Proclamations by prominent men afterwards printed.
3. Short talks at meetings of various kinds at the theatre, in public schools, and at luncheons or dinners.
4. Announcements at public gatherings such as society meetings, auctions, athletic events.
5. Pulpit notices and sermons.
6. Committee membership in scientific and economic organizations.
7. Solicitations of salesmen and organizers.

DEMONSTRATIONS

1. Mass meetings of people interested.
2. Receptions to special groups.
3. Group demonstrations by local sections, lodges, clubs, military organizations, etc.
4. Elaborate exhibits at conventions.
5. Parades on city streets and at fairs.
6. Stunts such as sandwich men, band wagons, etc.
7. House to house solicitations with samples.
8. Time allotments such as "Fire Prevention Week."

VISUAL REMINDERS

1. Posters and cards as: (a) billboards, (b) windows, (c) bulletin boards, (d) automobiles and trucks, (e) hotels, (f) railroad stations, (g) street cars.
2. Banners and streamers on streets.
3. Electric signs.
4. Tags, stickers and rubber stamps for use on letters, packages, pay envelopes, etc.
5. Handbills.
6. Inserts for use in packages of all kinds, books from libraries, mail, newspapers, and pay envelopes.
7. Displays in merchants stores, windows, and on sidewalks.
8. Exhibits in public schools, and posters and other work by school children.
9. Advertisements on theatre programs and score cards.
10. Slides and short news films for use in motion picture theatres.
11. General interest motion pictures for use in schools and theatres.
12. Technical motion pictures for conventions and selling.
13. Stereopticons and automatic lanterns in lobbies, store windows, public buildings and at night on vacant walls.
14. Cards of invitation, advance announcements, and programs.

The test of Public Information is "Do People Talk About It."

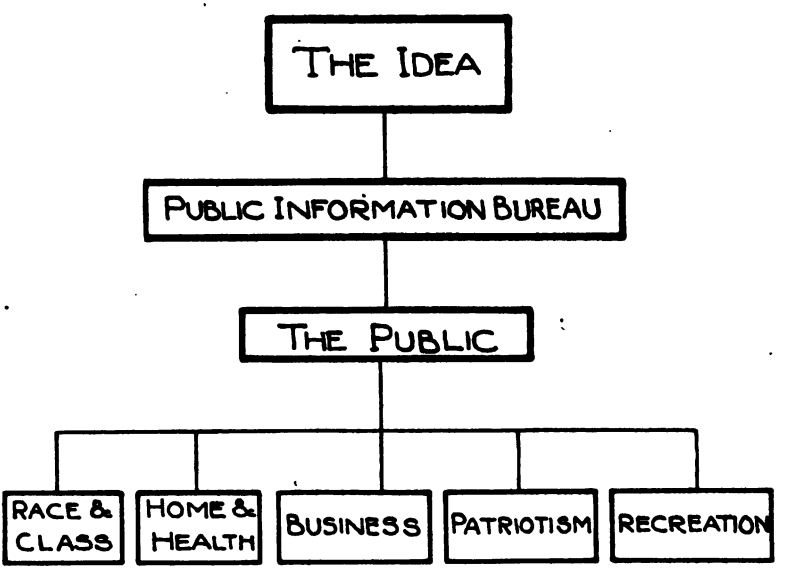


FIGURE 1

Varied Types of Appeal are Possible

Note.—This chart shows how the appeal of an idea may be directed to the part of the public which is most interested in each particular phase. The type of appeal is different for different units of the public.

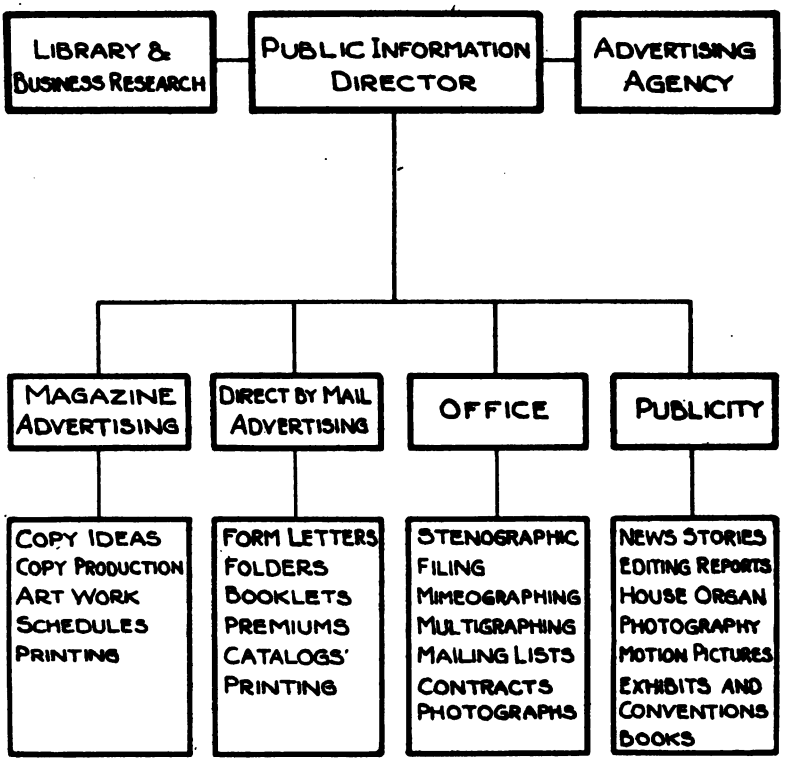


FIGURE 2

Functional Organization of a Typical Public Information Department

Note.—This plan for a public information department is developed for a complete organization acting independently and covering the entire field of advertising, institutional advertising, and magazine and newspaper publicity. No provision is made for service work or bookkeeping, and but small provision is made for co-operative work in educational institutions.

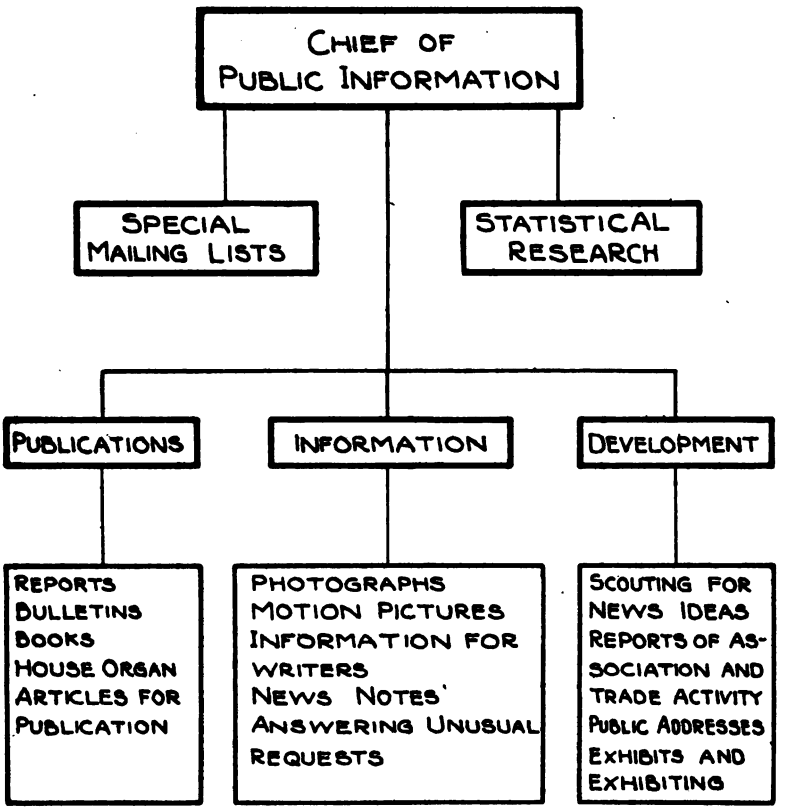


FIGURE 3

Functional Organization at U. S. Forest Products Laboratory

Note.—This plan for public information work is developed as part of a large advertising organization for a business; or independently for an educational or a promotional organization. The plan contemplates stenographic, filing, mimeographing, accounting, and printing service from sources outside of the immediate organization.

CHAIRMAN ROBERTS: I wish to advise you that Mr. Thomas practices what he preaches. When I was in communication with him regarding his address and later in preparing our program he suggested to me the advisability of using the technical press to the largest possible extent in announcing to the public the programs for the sessions of the Standardization Conference and offered us a list of 125 technical journals to whom we could send our announcements and advance programs.

He has given us most excellent suggestions as to how to sell our work to the industry. We believe thoroughly in it and expect to utilize his good suggestions.

I was impressed with the good teamwork that we are pulling off here in our addresses. Mr. Williams gave us in his address the basic reasons for doing the thing; Mr. Thomas has told us how to do it.

This paper is open for discussion, gentlemen. If you have any suggestions to make that have been prompted by this excellent address, or if Mr. Thomas has made any statements you take exception to, we would like for that testimony to go into the record as this is a democratic organization.

MR. LEGGETT: My comment is not so much on Mr. Thomas' paper as on the remark of brother Thomas on John Wesley. My impression of Colonel Roberts of Roberts & Schaefer is that he is more the father of shakers than of methods.

DR. AGNEW: I think that Mr. Thomas has performed a real service in putting due emphasis on the fact that Standardization and Research supplement each other and that they are not antagonistic. The Chief Engineer of one of the concerns that is chiefly responsible for the construction of electric lamps, I think, has put it most excellently. He says that standardization does not mean that we are going to stand still, it means that we are going to agree to improve together. I think that that is a very happy way of putting it.

I would like to also emphasize the point that standardization is in the last analysis a POPULARIZATION OF RESEARCH RESULTS. A peculiarly striking example of that, in a subject quite apart from mining or industrial work, is the fact that more than two centuries before the Christian era a man not only foresaw the general size and shape of the earth, but he measured it with an error of less than 100 miles. That was a really remarkable result for it was an error of only a little over two per cent. Think of the incalculable loss to the human race because there was no machinery for popularizing the results! The human race had to wait 16 centuries to have it painfully rediscovered.

There is another example that Mr. Thomas' address brings to my mind on that same point of research and standardization. This is a practical example—the electric light bulb that we have today. I don't know of an article in the whole of our production that is so thoroughly standardized as that bulb. I don't know any other kind of article that represents the kind of research work that has been expended in its production. A great deal of research work has had to be done in order to solve the technical difficulties in the way of development.

In that particular case standardization followed research with the smallest delay of any of the industrial arts with which I am acquainted. It seems to me that that is an example par excellence of the principle that Mr. Thomas has so ably brought out.

CHAIRMAN ROBERTS: Is there any further discussion of Mr. Thomas' address?

I just wish to announce that the gentleman who made that remark about me a moment ago, Mr. Leggett, is the one to whom we are indebted for securing Mr. Thomas. I didn't have the honor of Mr. Thomas' acquaintance when I was preparing this program and asked Mr. Leggett if he could make some suggestions and he made two most excellent suggestions, of which one was Mr. Thomas.

Our next address is the "Benefit of Standardization as Reflected by Insurance Rates," by Mr. C. B. Butterfield, manager of the Associated Companies. You may not all know who the Associated Companies are, and for those who are not acquainted with their work and activities, I wish to say that they are a group of associated insurance companies, and that they devote a great deal of their time and effort to trying to improve the mining industry as regards safety and economy and otherwise so benefit that industry as to lower these insurance rates, on the theory that has been advanced that in reduction there is profit.

They are a member of our general correlating committee and are actively associated with us in trying to promote safety and improvement generally in the mining industry. We are very greatly honored in having the manager of the Associated Companies give us an address on this subject. Mr. Butterfield. (Applause.)

THE BENEFITS OF STANDARDIZATION AS REFLECTED BY INSURANCE RATES

By

C. B. BUTTERFIELD, MANAGER, THE ASSOCIATED COMPANIES, HARTFORD, CONN.

Mr. Chairman and Gentlemen:

It gives me much pleasure to have been able to accept the kind invitation of your chairman, Col. Roberts, to address this gathering on a subject in which, I feel certain, you are all interested. The subject of compensation insurance is one which touches every phase of industry, and its application to coal mining is of special importance because of the hazards involved. I will, therefore, give you briefly a review of the benefits of standardization as reflected by insurance rates, using as illustrations the methods employed by my Company.

The benefits of standardization in connection with compensation insurance as applied to coal mining are primarily two: first, humanitarian in reducing death and suffering as results of accidents, and second, economic, in reducing the number and cost of claims arising from accidents, with attendant lowering of the cost of the insurance. To this latter must also be added increased productive efficiency due to the lessening of lost time of experienced men and the decreased property damage which damage is so frequently encountered from explosion and other causes where standard safety measures are not adopted.

The coal mine safety standards are a part of the inspection and rating schedule originated by the company which I have the pleasure of representing and consist of a series of regulations setting forth the best mining practice, from a safety point of view, in connection with those operations which experience has shown to be the most prolific source of accident, full consideration having been given to productive efficiency. Each condition contemplated by the standards is given a percentage weight according to its relation, as a source of accident, to the

other conditions collectively; and this weighing is applied as a credit or debit to the minimum rate in the light of the standard or substandard conditions which exist. If physical conditions were the only ones with which we had to deal, our task would be a comparatively easy one. However, as you know, the human element is a most important factor where accident prevention is involved and for this reason our standards require the use of what we term an educational program. One of the first benefits derived from our standards is the result of this educational work which is devised with a view to making the men think and act quickly when emergencies arise. This is accomplished by first arousing interest in the subject through safety committees in which the miners themselves take a leading part. In a mine of average size, we organize a Mine Safety Committee composed of local mine officials, company men and miners, and in addition, a Central Safety Committee consisting of executive officers. In the larger mines the educational work, made effective through these committees, is in charge of an overseer known as a Safety Engineer, whose full time is devoted to working out safety problems and installing safety practices and equipment. The men having been interested in "safety first" are asked to submit to the Mine Safety Committee any suggestions or recommendations which they believe, if adopted, would be a benefit to the mine and its employees. To further the interest in this work a bonus is generally given for the best suggestion accepted by the Committee each month. Safety circulars are published by our Company at regular intervals in the English and foreign languages in order to further the interest in this work. We have recently issued a circular on the subject "Explosion Season," which exists from October 1st to April 15th. This circular informed the miners and mine officials of the approaching explosion season and reminded them to watch for and avoid explosion conditions. The educational work is further augmented each year by a safety meet and by rallies held at various local points and the winners of many of these meets are given, as a prize, the privilege of attending the Annual International First Aid Meet which was held this year in St. Louis. We are deeply interested in instructing the mine employees in First Aid and Mine Rescue Work, many of our Inspectors being experts in this line. The Bureau of Mines and our Inspectors train mine employees free of charge and issue an attractive certificate revealing the fact that the person in question is qualified. It is impossible to estimate the benefits that have been derived from this educational work, but the results are reflected in the humanitarian benefit and the reduction in the number and size of claims presented to the Insurance Companies. For example, in exploration work following mine disasters, we often find miners barricaded so as to protect them-

selves from the onrush of poisonous gases. Such acts of self-preservation are direct results of the training given in our standard educational work.

From the educational phase we pass to the more practical side of the subject and take up the more important physical aspects. In case of accident or disaster it is of prime importance to have facilities for quickly summoning aid, and for this reason we require telephone connection on the surface at all mines, regardless of size. Furthermore, we require an inside telephone connection in every section located more than 2000 feet from the mine entrance in which there are 10 or more men employed, and this inside telephone must be of a standard enclosed type so that it is properly protected from the elements. From an operating standpoint, one of the most important considerations of the mining industry is that of illumination and this question becomes a vital one from a safety viewpoint in gaseous operations. In such mines, our standards prohibit the use of carbide lights and call for permissible electric gas lamps or flame safety lamps. However, full credit is not given for the use of safety lamps, in view of the fact that they do not furnish adequate illumination although either type can be used with safety in explosive gas. In non-gaseous mines, we specify either one of these closed lights or accept carbide lights.

A very essential provision in a mine from a humanitarian view point is the escapeway. In all shaft mines, we require an escape shaft at least 200 feet from the main hoisting shaft, each one of which must be equipped with a hoisting cage or with a stairway kept in passable condition throughout the entire year. In slope or drift operations, we require separate escapeways at a safe distance from the main haulage road. As an illustration of the necessity of escapeways and the actual use to which we place them, it might be of interest for you to know of a mine employing 500 men underground which we recently inspected. From the number of employes, you can readily realize that it was really a small town below the surface. This was a non-gaseous mine having a mine fire sealed off over a large area. The stoppings were so warm that one could not hold one's hand against them, yet the only means of escape which had been provided was directly past these stoppings. Our inspector discovered this serious situation and before we would accept this risk for compensation coverage, we specified that the escapeway paralleling this haulage road past the mine fire must be placed in a safe condition for travel. This required a large expenditure of money but such standardization of this traveling way may mean the saving of the lives of these men.

Our surface requirements are standardized in that we insist upon the electrical equipment being protected by guards of approved designs. This protection is afforded by circuit breakers, grounding, cut-out switches and by wooden and rubber mats,

and all power plants must be inspected periodically by experts. Because of the ropes, cages, haulage engine, safety gates and the like shaft operations are the most difficult ones to operate from a safety view point and we insist that all hoisting ropes have an ultimate breaking strength of ten (10) times the maximum load, that they be properly installed and inspected daily. We require that the top, ground and intermediate landings of the shaft be equipped with automatic safety gates, which operate with the action of the cage; or, in the absence of this equipment, that, an employe be located at each landing while the mine is in operation, and an ordinary gate placed across the opening during his absence.

Approximately 5% of the accidents in mines is due to the rolling stock, and for this reason our standards require that all mine cars be equipped with 6″ bumpers on each and giving a 12″ spacing between cars. In addition, we require that wheels and axles be maintained in a safe operating condition at all times. No employe other than the motorman and trip rider is permitted to ride the trip in either direction.

In mine development, the direction of the main entry is determined by the pitch of the coal seam and the field to be operated, and for operating reasons the entries are driven in certain prescribed directions. Despite the fact that we have escapeways, it is frequently necessary for employes to travel haulage roads and even though all precautions are taken, the releasing of a trip with its resultant runaway often occurs. To provide places of safety for pedestrians in these emergencies, our standards require that shelter holes be cut at frequent intervals along haulage roads and that ample clearance in which employes can walk with safety past locomotives and mine cars be provided. To enable the men to quickly locate places of safety, they are marked by electric lights and whitewashed. With a view to minimizing the chances of derail, our standards require that tracks and roadbeds be in A No. 1 condition, the rails to be of sufficient weight to carry the load and firmly attached to ties. On mechanical haulage roads, we require all joints to be plated and the track to be properly aligned and free from defective construction such as high and low joints.

The increased use of electrical equipment has introduced shock and explosive hazards which must be adequately guarded against. Our Standards require that special attention be paid to the protection of employes from shock and that trolley and feed wires be installed so as to avoid the possibility of mine fires. All rails on main haulage roads must be bonded and all electrical apparatus underground must be of explosion proof construction.

Roof and timbering is one of the most important subjects for standardization with which we have to contend, since falls of roof produce about 60% of all accidents, many of which are fatal.

The roof is a natural condition over which we have no control except that obtained in the method of mining and through our standards of good timbering. The system of timbering required depends upon the method of mining and the width of the entry or working place, but we insist upon three (3) rows of props set on four (4) foot squares for poor roof, while better roof can be safely timbered at greater intervals. In view of the fact that the largest number of men are killed or injured at the working face we require props to be set not further than six (6) feet from the face before shooting and, when the coal is not blown down by explosives, and pick mining is resorted to, we require the props to be set within four (4) feet of the face. We do not overlook the subject of properly spragging undercut coal, as many of our men are killed or injured in this operation as a result of not setting the sprag. This is a turnover hazard which must be carefully guarded by spragging the undercut coal, once in seven (7) feet. So important do we regard the subject of roof that an extra inducement is given to operators by giving special credit for inspection. Many of our mines procure a reduction of twenty-five (25) cents per one hundred (100) dollars of payroll by the installation of exceptionally good inspection service.

The U. S. Bureau of Mines has greatly aided the Mining Industry by experimental work in explosives for gaseous mines. We have permissible explosives which are approved by the Bureau of Mines and can be used with safety in gaseous operations. When permissible explosives are used in the quantities and in the method prescribed by the U. S. Bureau of Mines, adverse results need not be feared. Permissible explosives are short flamed and the quick flash permits the powder to do its work without the ignition of gas. The subject of explosives is not one of so much importance in non gaseous mines except that we ask for the installation of permissible explosives but will accept black powder; and do all in our power to discourage the use of dynamite. The firing of shots, however, presents a catastrophe possibility in gaseous and dusty mines and our standards require the employing of shot firers who must load, tamp and fire all holes. These men are experts in their work and have no other duties. In order to protect the lives of shot firers we specify the use of electric batteries with 100 feet of lead wire thus permitting the shot firer to obtain a place of refuge before igniting the charge.

Unaided by mechanical means fresh air penetrates mine workings but a short distance. A study of this subject deals with but one standard for safe operation and that is mine fans. We specify the fact that certain prescribed volumes of air must be forced into the mine according to the number of men employed and the number of animals used underground. This requirement governs the size of the fan, which must be installed on the surface, be of a reversible type, and strongly and tightly constructed

and enclosed with fire resistive material. In gaseous mines we specify explosion doors which, in case of a mine expolsion, relieve the pressure thereby saving the fan, which must be operated twenty-four (24) hours per day. The air currents circulate through a mine like electricity through an electric circuit. There must be an intake and return air course, and in order to provide this system cross cuts between entries must be closed, our standards requiring that such stoppings be constructed of concrete, brick tile or masonry with the exception of the last three cross-cuts, which may be constructed of wood. This combustible material is permitted at these points in order to localize an explosion at the working face.

The possibilities of catastrophe are grouped in our standard under the subjects, gas, dust, solid shooting, mine floods and fires. The gas hazard is reduced to a minimum by the use of closed lights, adequate ventilation and permissible explosives. The dust hazard is taken care of by sprinkling or otherwise rendering inert. We discourage the practice of solid shooting and in any mine in which coal is shot off the solid, we require shot firers to inspect, load, tamp and fire all holes. With this requirement we also specify permissible explosives regardless of whether the mine is gaseous or non-gaseous. All men must be out of the mine when coal is shot off the solid with the exception of the shot firers and other persons delegated by the Mine Foreman to safeguard property.

We carry many mines exposed to the flood hazard, some of which are in themselves a natural drainage basin, and large volumes of water are confined by means of dams. We also encounter a flood hazard from the collection of large volumes of water in old workings. In these cases we require barrier pillars to be maintained in accordance with the Mine Law, but, if the Mine Law permits barriers of less than fifty (50) feet in thickness, we will not accept them as standard. When an entry or working place is driving toward a flood area we require advance bore holes to be kept twenty (20) feet ahead of the working face.

Mine fires are not uncommon in coal mines, many of them having burned for years, it being apparently impossible to extinguish them. It is our endeavor, therefore, to restrict mine fires to certain areas and our standards require that they be sealed off so that no noxious gases from the fire may be carried through the mine. A daily examination of the seals is insisted upon.

The humanitarian aspects of the foregoing phases are of vital interest to the community and the nation as a whole. The toll of human life and limb taken by our industries annually must impress all thinking citizens, not only from the human but from the economic side of the question. You will, I am sure, agree

with me when I say that the first thought of any industrial management should be the preservation of life and the mitigation of suffering and disablement to the ultimate degree. The economic aspect is not only reflected in the increased cost of production due to the rating on compensation insurance but entails the loss, through disability or death, of a productive worker, which is, of course, the unit in our economic system. In addition to this, although the compensation benefits provided by law are liberal, the injured frequently becomes a charge upon the community in one way or another. As an indication of what the introduction of compensation insurance has accomplished along these lines, I want to call your attention to certain statistics on the subject of fatal accidents in coal mining operations. For this purpose I have chosen the State of Pennsylvania, where the compensation law became effective on January 1, 1916, and has been in operation longer than in any other state. Our statistics indicate that during the five years from 1911 to 1916, inclusive, there were 3.11 fatal accidents per million tons of coal mined in that state and that during the five years following the inception of the law fatal accidents were reduced to 2.81 per million tons of coal mined. A similar decrease in the death rate has been recorded in other states and like reductions in the number of accidents entailing total or partial disability have been effected. These reductions are without question direct results of the standardization of mining operations from the viewpoint of safety and have been the means by which reductions in the cost of compensation insurance to their present low levels have been brought about.

Turning to a consideration of the strictly financial side of the question we must first consider the operation of the schedule earlier referred to. The changes for sub-standard conditions carry the same weight in all states, but this weight is necessarily on a percentage basis for the reason that the base rates of all states are not the same. This is accounted for by the difference in requirements of the compensation laws in the various states, some of which are more liberal in their awards and more comprehensive in scope than others. As an example, in the state of Kentucky we must earn the average on all mines of $3.40 per hundred dollars of payroll, while in Alabama it is only necessary, in order to successfully carry on the business to earn an average or base rate of $3.15. These differences in base rates give to item values different charges in parts of a dollar, but the item values having the same weight operate in similar proportion from state to state. The minimum rate (which as a rule is 60 per cent of the base rate just referred to) is taken as the basis for applying the charges produced on the schedule rating plan. The sum of the charges when added to the minimum give the schedule rate for the mine in question, suitable credit

being subtracted from the total for educational and inspection work.

As regards the application of schedule rating, we require that the mine have a payroll of at least $10,000 per annum, while mines of sufficient size to develop a payroll of $100,000 in eighteen (18) months must under the insurance law be experience rated. The experience rate is based upon the actual loss ratio sustained through accident, and is effected by applying the debit or credit, according to the accident experience, to the schedule rate. Thus with favorable experience which usually results from co-operation by the management in our standardization program, even greater reductions in rate can be affected than those which have already resulted from the application of the schedule rating plan. We have many risks that have had the rate reduced by experience credit as much as 75 and 80 cents per hundred dollars of payroll, while others, where an unfavorable accident frequency has been experienced have of course been debited.

From this it will be seen that much depends upon the operator in faithfully complying with the requirements of our standards, and, with the exception of a very few cases where natural conditions are extremely bad, I can say that where the mine officials have co-operated with us in standardization there has been an appreciable lowering of the rate. This lowering refers to current policies in addition to which we must consider the reductions which have been effected in base rates since the inception of the compensation law, as a result of the improvement through standardization of the mining industry in general.

We have then two distinct financial benefits of standardization as applied to coal mine compensation insurance: the direct benefit, in the reduction of rates because of the favorable accident record brought about by the introduction of safety measures, and the indirect economic result in lessening the number of disabled men, and widows and orphans incapable of self-support. In addition and of even greater importance we have the great satisfaction of preserving life, minimizing disability and preventing unnecessary suffering.

CHAIRMAN ROBERTS: I do not know of any better testimony to offer to the work which we are trying to carry on than to note the parallel between the great work carried on by these Associated Companies and the work which we are trying to do. It is for that reason that we are working together now through the General Correlating Committee to try to accomplish similar results, although our work is very much broader in its subject matter than theirs.

At our forenoon session of the General Correlating Committee, we decided to appoint a sectional committee with membership from the several national organizations that are interested in this work, to try to formulate a new and better state mining law to offer to the states for the protection of life and property in the mines of this country. I think that this address will indicate to us that the Associated Companies have a vast amount of valuable data that they can contribute for the use of

this committee in formulating these basic regulations for our state mining laws.

You understand that these Associated Companies have no way of compelling the adoption of their standards, but they have a most excellent method of encouraging the adoption of those standards because your insurance rates are in proportion to the extent to which you adopt these safety regulations. In other words, your mine is classified according to its safety, and that is a very great inducement for the gradual adoption of their safety regulations.

In hearing the statistics regarding the reduction of fatal accidents, I recalled that Mr. Callbreath, the Secretary of The American Mining Congress, made the statement in an address at a luncheon day before yesterday that in a recent year the fatal accidents in the United States were over 3,200, and that last year, 1920, fatal accidents were about 1,900 and that this great reduction in the loss of life in the mining industry, despite the fact that production had very greatly increased with many more mines and larger production, was due to the efforts of such organizations as the Associated Companies, the National Safety Council, The American Mining Congress and those who are working for improvement in the mining industry, and I should also add the Bureau of Mines, because their work is at all times very comprehensive.

Are there any questions that you would like to ask Mr. Butterfield regarding his address?

If not, we will have our next address on the Standardization Movement in Canada. When we were preparing this program we thought it would be very appropriate to hear from our Canadian friends and learn what they were doing along the lines on which we are working. We finally induced Dr. E. J. Durley, Secretary of the Canadian Engineering Standards Association, to present an address with the understanding that he would come and deliver it, if possible. He found it impossible to be here this week; he therefore mailed his address to us and asked that Dr. Agnew, his very good friend, should read it.

DR. AGNEW: It is indeed a pleasure to present Dr. Durley's address. (Applause.)

THE STANDARDIZATION MOVEMENT IN CANADA

By

R. J. DURLEY, SECRETARY, CANADIAN ENGINEERING STANDARDS ASSOCIATION.

The first steps towards the organization of engineering standardization work in Canada were taken in 1918, when, at the suggestion of the British Engineering Standards Association, a committee of prominent Canadian engineers and industrialists was formed to deal with the matter. This Committee, after a good deal of preliminary work, came to the conclusion that a distinctively Canadian Standardization body was desirable, and that owing to the industrial and economic conditions existing in Canada, the Committee or Association to be formed should have a wider scope than could be possessed by any committee forming part of a British or American organization. Industrial and engineering work in Canada is, however, so largely influenced by our proximity to the United States, and by the close commercial relations existing with Great Britain, that any Canadian Engineering Standards Committee or Asso-

ciation must necessarily keep in the closest possible touch with the bodies doing similar work in those countries.

It was accordingly decided to form an Association, the constitution of which was to be modelled on that of the British Engineering Standards Association and which should be fitted to act as the central organization for industrial standardization in Canada. It was thought essential that this body should be supported and largely maintained by the industries concerned, while at the same time the support of the Federal Government was considered indispensable.

The original Committee was accordingly enlarged and expanded, and in 1919 the **Canadian Engineering Standards Association** was incorporated by Dominion Charter. Its **Main Committee**, the duty of which is to direct and manage the affairs of the Association, to appoint the chairman and members of the working committees, and to examine and approve proposed standards before publication, is composed of forty-three members, part of the membership being nominated by such bodies as the Engineering Institute of Canada, the Canadian Institute of Mining and Metallurgy, the Canadian Manufacturers Association, the Engineering Schools of the Universities, and other public and semi-public bodies, while certain other members are nominated by the principal departments of the Dominion Government, and the remainder are co-opted as being desirable representatives of important industries such as railway work, pulp and paper manufacture, steel manufacture, and the like.

The Main Committee has appointed a number of **Sectional Committees**, each charged with the duty of supervising the activities of the working committees in some particular branch of industry. There are at present ten of these sectional committees dealing respectively with:

Aircraft Parts,
Electrical Work,
Rails and Track,
Wire Rope,
Steel Bridges and Construction,
Screw Threads,
Machine Parts,
Mining Machinery,
Steel,
Cement and Concrete.

Under each Sectional Committee there are organized the necessary **Sub-Committees** (at present eighteen in number), which are actually responsible for the technical work of formulating proposed standards, and whose members are appointed by the appropriate sectional committee, subject to the approval of the Main Committee. Whenever necessary, **Panels** (usually

consisting of a smaller number of members) are formed under the Sub-Committees to study and report on minor points which may require detailed enquiry or investigation.

It is the aim in every case to include in the membership of the working committees, representatives of all the important producing and purchasing interests concerned, together with such technical advisers as may be considered desirable. The actual discussions as regards technical details are thus carried out by specially chosen representatives of the manufacturers and purchasers, and the various interests, whether of the producer, user, or the engineer, are safeguarded, since all these parties have a voice in the decisions reached.

The services of the various Sectional and Sub-Committees are, of course, available for the periodical revision of their publications, for which arrangements are regularly made in order to avoid any risk of retaining a standard in use after changes in practice have rendered it obsolete in any respect.

From the inception of the work, the Main Committee has adopted the principle that action shall only be taken in cases where a request for standardization work is received from some responsible organization or firm, and in each case adequate enquiry is made, by circularizing the industry or otherwise, to determine whether the proposed activity will have the support of the parties concerned.

In Canada, as in other countries, some popular uncertainty seems to exist as to the use of the term "Standardization," some taking it to include only the work of measuring, calibrating, or comparing scientific instruments, measures of length, and so on, while others understand that it refers to the preparation of such designs, dimensions or specifications in industrial, manufacturing, or construction work as will be generally accepted and worked to by all concerned.

The latter is, of course, the line of work along which the activities of the Canadian Engineering Standards Association are directed.

It should be noted also that the scope of the Association is not considered to include the carrying out of any tests which may be required to determine whether or not a given product complies with its specifications or dimensions. The duty of the Association has been done when a standard has been formulated and published in such a form as to meet with the general approval of the interests affected, and when provision has been made for its periodical revision.

The experience of the last two years has shown that standardization work in Canada presents features not only of particular interest but also of special difficulty. While it would appear at first sight that in many instances British or American standards could be adopted without change, owing, in the former case,

to the fact of geographical proximity and industrial connection, and in the latter, to the intimate commercial relationship existing, this is not always found to be the case in practice. Differences in industrial conditions and in the class of material and workmanship available, differences in climatic conditions, and in legislative restrictions, tend in many cases to make differences in practice necessary or advisable.

Our Committees have to bear in mind in framing their requirements that while domestic industry must receive the first consideration, the interests of the purchaser and importer are also affected, since in many branches it is necessary for us to import not only material in a raw or semi-finished condition, but also manufactured machinery or completed engineering products.

Speaking generally, it may be said that as regards dimensional standards, as, for instance, in ball bearings, screw threads, gearing, and the like, American practice is usually followed, and in many cases it may be found desirable to adopt American standards without alteration. In other cases, as, for example, the preparation of specifications for material, the influence of local conditions is often strongly felt, and in such instances specifications of our own, possibly differing from both British and American practice, are being developed. The closest co-operation is, however, being aimed at, both with the British Engineering Standards Association and with the American Engineering Standards Committee, and as it is even hoped that in the case of certain British and American Standards it may be possible for the Canadian organization to assist in bringing about international agreement.

Among the American Standards which have received wide acceptance in Canada may be mentioned the United States Standard Coarse Thread, Fine Thread, and Pipe Thread, the rules of the Society of Automotive Engineers affecting the automobile industry, and the Standardization Rules of the American Institute of Electrical Engineers as applied to electrical products. Further, in connection with railway work, the interchange of traffic obviously makes it necessary for Canadian practice to agree substantially with American Standards as regards locomotive, car, and track work, and our railway bridge specification is in general agreement with the practice adopted by the American Railway Engineering Association.

During the past eighteen months our Association has published the following:

No. 1, 1920 — Standard Specifications for Steel Railway Bridges.

No. 1A, 1920 — Standard Specifications for Steel Railway Bridges. (Separate reprint of Material Specifications.)

No. 2, 1920—Standard Requirements for Distribution Type Transformers.

No. 3, 1921—Standard Specifications for Galvanized Telegraph and Telephone Wire.

The following are in preparation and will shortly be issued:

Standard Specification for Steel Highway Bridges.
Standard Specification for Steel Railway Bridges (new edition).
Standard Specification for Wire Rope for Mining and Dredging Purposes.
Standard Specification for Portland Cement.

Among the subjects for which working committees have been, or are being, formed are the following:

Canadian Electrical Code,
Incandescent Lamps,
Distribution Type Transformers,
Station Type Transformers,
Galvanized Telegraph and Telephone Wire,
Watthour Meters,
Wood Poles,
Rating and Testing of Electrical Machinery.
Wire Rope for Dredging Work,
Wire Rope for Mining Work,
Wire Strand,
Steel Railway Bridges,
Steel Highway Bridges,
Rivet Heads,
Mining Drill Chucks and Steel,
Material for Steel Forgings,
Cement,
Concrete and Reinforced Concrete,
Impedance in Transformers,
Steel Reinforcing Bars,
Flexible Steel Wire Rope for Aircraft,
Steel Tubes for Aircraft,
Steel Sheets for Aircraft.

A few notes on some of these may be added:

In Canada, provision for the public safety (as affected, for instance, by electrical installations and equipment) is not under federal jurisdiction, the various provincial governments holding this responsibility. The Provinces have shown great diversity of method in dealing with the matter, in one case (the Province of Ontario) a very complete code of rules having been adopted as applying to all electrical installations in the Province, and covering the same ground as the U. S. National Electric Code, the Underwriters Specifications, and the National Electrical Safety Code. In certain other localities the question of electrical regulations has been placed in the hands of commissions

whose powers are not so wide, and in many cases no adequate legislative action has been taken.

The rules of the U. S. "National Electrical Code" as applying to fire hazard are recognized and used by the various Fire Underwriters' Associations in Canada, but these are not specially applicable to life-hazard and have no legal force except where they have been officially adopted by local authorities, in which case they are commonly supplemented by additional rules which exhibit much diversity. As a result, the manufacturers of, and dealers in, electric appliances and equipment are suffering considerable inconvenience, as equipment or fittings may be approved for use in one locality but may be regarded as quite unsuitable in a neighboring city or province.

The Association is now endeavoring to arouse Dominion-wide interest in this matter, with the view of organizing a thoroughly representative committee and bringing persuasion to bear upon the various Provincial Governments in order to unify their requirements and remedy the present unsatisfactory conditions. In this work there is no doubt that the results of the activities of the two American committees, dealing respectively with the National Electrical Code and the National Electrical Safety Code, will be fully considered and appreciated.

Much of the Safety Code work now being actively pressed forward in the United States is of great interest to Canadian industry, and in many cases, such as the Elevator Safety Code, and the Safety Code for Logging and Sawmill Machinery, we have received cordial invitations to co-operate, which have been greatly appreciated.

The Standardization Rules of the A. I. E. E. are very largely, if not universally, worked to in Canada, especially in connection with the rating and testing of electrical machinery, but they have so far not received official endorsation from any public or industrial body in Canada. The Association is forming a representative committee with instructions to report upon this question and advise how far it will be desirable to adopt these standards formally.

The publications of the Association have hitherto not included any standards of a dimensional nature, and at present it seems likely that comparatively little independent work of this particular kind will be required in Canada. In the field of specifications, both for materials and engineering products, however, this condition does not hold good, and requests have been received for the formulation of standard specifications for a number of materials and products, some of which have not yet been dealt with by American Standardization authorities. Among these may be mentioned **Wire Rope for Mining Purposes**, a specification for which, as already stated, is now in the press. This specification lists the regular constructions to be adopted

as standard by makers for Canadian use, and while avoiding controversial points as far as possible, prescribes the necessary tests which are regarded as being necessary to protect the user, manufacturer and importer against rope of inferior material and construction.

Another item of interest to the Standardization Conference of The American Mining Congress will be the question of **Mining Drill Chucks and Steel.** A sub-committee was formed by the C. E. S. A. for the study of this question in 1920, and a good deal of information has been collected as regards the diversity of practice in the various mining districts of Canada. It is desired, if feasible, to limit the number of sizes and shapes of steel in use, and also to obtain as much unification as is possible in the design of drill chucks. Our Committee is naturally very desirous of working along lines parallel to those adopted in the United States, and, after a survey of the subject, is awaiting the results of experimental work and developments in American practice which are understood to be in progress.

It is hardly necessary here to go over the work of all of our Committees, but the foregoing notes will have sufficiently emphasized the desire on the part of all concerned for effective co-operation with the American standardizing bodies. Our relations with the working committees of the important technical organizations, as well as with their co-ordinating body, the American Engineering Standards Committee, have been and continue to be very cordial, and the Main Committee of the C. E. S. A. is happy to take this opportunity of drawing attention to this fact.

MR. McGRATH: Does any one wish to discuss any points in the paper just read? I wish to say that these papers were prepared for publication in addition to being delivered in person, and we realize that a great number of the papers contained data that is a little bit dry to listen to, and in finishing up the standardization work Colonel Roberts is of the opinion that in the future he will be able to get his committees to group their reports in such a way that they can refer to their statistical data and not read it, but it will be included in the printed reports.

I might also say that a great number of the members realize that this will be printed and they expect certain discussions on it and they all look forward to the publication of these speeches; and if any of you have any ideas to present, they should come up now. Because of the fact that we have about five different conferences going on at one time, they cannot attend them all and those present are expected to discuss the points for them in a way. Of course they should not do it, but they do.

Our last speaker on the program is Col. Warren R. Roberts, but before announcing Colonel Roberts, I wish to state that in the metal mining industry about 80 or 90 per cent of all the metal mines are not operating at the present time; or if they are operating, they are operating at a very curtailed output, so that the committee members were not able to be present except in very small numbers.

The metal mines are from 1,000 to 2,000 miles from Chicago and they were not able to make the trip to attend this Convention, but they are

all looking forward to the publication of these reports and this year they have promised us these reports will be published within six weeks.

I now wish to announce that we will have an address on "National Coordination of Standardization through the General Correlating Committee," by Col. Warren R. Roberts. (Applause.)

CHAIRMAN ROBERTS: Mr. McGrath, in announcing that Dr. Secrist could not be present, did not say he was in the hospital. We regret that Dr. Secrist was unable to even prepare an address to be read as he was taken ill two or three weeks ago and is still ill.

My address will be very short and I would postpone reading it and have it printed, only there are a few thoughts in it that I want the members, who are present to have now regarding this coordination of our work with other organizations.

NATIONAL CO-ORDINATION OF STANDARDIZATION THROUGH THE GENERAL CORRELATING COMMITTEE

By

COL. WARREN R. ROBERTS, PRESIDENT, ROBERTS & SCHAEFER COMPANY, CHICAGO.

The two special programs of the Standardization Conference for Wednesday forenoon and Thursday afternoon, including the selection of the subjects and the speakers, were arranged some time since with a great deal of care to cover, in as thorough a manner as possible, the general subjects selected for these two sessions.

As originally planned, the subject which I am now to discuss was given to Prof. E. A. Holbrook, Assistant Director of the U. S. Bureau of Mines, as he is the Chairman of the General Correlating Committee. However, in developing these two programs it became necessary to allot a different subject to Prof. Holbrook on Wednesday forenoon, and the speaker, being Vice-Chairman of the General Correlating Committee, was under the necessity of taking his place on today's program.

I did not realize how formidable a sounding subject had been selected for this address until I handed our program to one of my friends and called his particular attention to the subjects and speakers for these two special sessions. My friend read through these two programs carefully until he came to No. 7, for Thursday afternoon, when, after considerable hesitation, he endeavored to read the title of this number, and after stumbling through all these long words, he was finally stumped on "Correlating" and ended by saying, "Hell of a subject." I admitted the allegation, but then explained to him that this subject was not selected because of the many high-sounding words, but because it correctly described the subject matter for this address.

A full statement of the organization and development of this General Correlating Committee was given at our last Standard-

ization Conference, and is contained in a Standardization Bulletin issued recently by The American Mining Congress. I will, therefore, give you only a statement of the necessity for this committee in carrying out the standardization program of the several member bodies of the committee.

There are several national engineering societies and industrial organizations that have committees working on programs of "Standardization," "Safety," and kindred subjects which somewhat parallel the work of the Standardization Division of The American Mining Congress. It therefore seemed advisable to organize this committee with representation from each of the societies or organizations that were interested in this work of Standardization for the mining industry. Therefore, about a year ago, this committee was formed and proceeded to develop plans for correlating the work of the various committees referred to above.

Since our last Standardization Conference this committee has been partially reorganized and considerably expanded to include other societies and organizations making application for admission to this work.

As now constituted, the committee is composed of two classes of memberships, viz., ACTIVE and ASSOCIATE MEMBERS.

> "Organizations entitled to active membership on the Committee are those national bodies whose sole interest is in mining. National organizations only a part of whose work lies in the mining field are entitled to representation on the Committee as ASSOCIATE MEMBERS, without vote, but to be consulted whenever affairs relating to their parts of the industry are under consideration."

The following is the personnel of the present committee:

ACTIVE MEMBERS

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

Howard N. Eavenson, Consulting Engineer, Pittsburgh, Pa.
Graham Bright, Westinghouse Elect. & Mfg. Co., East Pittsburgh, Pa.

THE AMERICAN MINING CONGRESS

Charles A. Mitke, Consulting Engineer, Bisbee, Ariz.
Col. Warren R. Roberts, President, Roberts & Schaefer Co., Chicago, Ill.

NATIONAL SAFETY COUNCIL

B. F. Tillson, Assistant Superintendent, New Jersey Zinc Co., Franklin, N. J.

S. J. Williams, Secretary and Chief Engineer, National Safety Council, Chicago, Ill.

U. S. BUREAU OF MINES

Prof. E. A. Holbrook, Assistant Director, U. S. Bureau of Mines, Washington, D. C.

O. P. Hood, Chief Mechanical Engineer, U. S. Bureau of Mines, Washington, D. C.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, New York City

F. L. Stone, General Electric Co., Schenectady, N. Y.

THE ASSOCIATED COMPANIES, Hartford, Conn.
C. B. Butterfield, Manager.

REPRESENTED BY

J. H. Griftner, Mining Engineer, Associated Companies, Hartford, Conn.

ASSOCIATE MEMBERS

NATIONAL SAFETY CODE COMMITTEE

The General Correlating Committee function under and report to the American Engineering Standards Committee and represent this committee on all matters of Standardization as applied to the mining industry. At the last meeting of the committee "it was agreed that the functions of this committee should be to suggest to the American Engineering Standards Committee subjects for standardization, recommend sponsors, define the scope and limits of a proposed standard; assist in adjusting conflicts or clearing up ambiguities; follow up work under way, and report from time to time upon progress made within its field of activities."

Since the member bodies of this General Correlating Committee have committees working on subjects, some of which wholly apply to the mining industry and others which only partially apply, and since some of these organizations have developed a very considerable program on Standardization, as applied to the mining industry, and to prevent as far as possible the interference with such work, it has been arranged that the method of procedure shall be as follows:

Each of the members of the committee are to pursue their present programs of standardization and whenever any of them have completed any patricular portion of their work, which they wish to submit to the industry as a standard, such work shall be first submitted to the General Correlating Committee, who in turn will submit it to the various members of the committee for their consideration and approval, or for suggestions.

Should such work be approved by all members of the committee, then it is submitted by the committee to the American Engineering Standards Committee as an American standard.

Should it develop that there are sufficient suggestions or revisions to the work as submitted by the members of the committee, then a sectional committee will be formed to review such work, this sectional committee to be composed of representatives of all members of the General Correlating Committee who are interested in the subjects submitted.

This sectional committee will then revise and approve such work and re-submit it to the General Correlating Committee for submission to the American Engineering Standards Committee as an American standard.

Members of the General Correlating Committee who are much interested in any such subjects submitted are to act as joint sponsors with the member submitting such subjects for revision, while other members who are only partially interested in such subjects are to have representatives on the committee to hear the evidence, make suggestions, etc., but do not have a vote in reaching any conclusions regarding the subject.

It is very interesting to know that while this General Correlating Committee has been organized only a short time, and that while the very nature of their work of harmonizing the activities of all the societies and organizations interested in standardization of mining methods and equipment, that they have made very material progress—first, in having completed a good, workable organization, adopted regulations for directing this important work as outlined above, and now have under consideration from the members of the committee the following important subjects on which sectional committees will doubtless be formed at a meeting of the General Correlating Committee to be held during the present week here in conjunction with the Standardization Conference:

SAFETY CODE FOR LADDERS: The American Society of Safety Engineers, having a committee preparing a "Safety Code for Ladders," have inquired of our committee whether we would be interested in that portion of their subject as applied to mine ladders, etc., and have been advised that several members of the General Correlating Committee are interested in this subject and will wish to be represented on any Sectional Committee formed to consider the matter.

MINE VENTILATION. The American Society of Heating and Ventilating Engineers, having accepted sponsorship for a "Safety Code for Ventilation in public, semi-public and industrial buildings," have inquired whether our committee would be interested in the formation of a Sectional Committee to deal with the ventilation of mines, and have been advised that The

American Mining Congress and some other members of our committee are not only interested in this subject but have committees working on Mine Ventilation with a well developed program.

UNIFORM MINING LAWS: At the last meeting of our committee it was decided to inquire from each of the organizations represented on our committee, if they wished to be represented on a proposed Sectional Committee for formulating basic mining regulations, it being understood that this Sectional Committee would undertake to draw up the minimum requirements for a good and uniform State Mining Law.

The Chairman of our committee advises that several of our members have responded favorably and that such Sectional Committee will doubtless be formed at the present meeting of the committee.

The U. S. Bureau of Mines has submitted to our committee three proposed tentative American Standards:

(1) Safety Rules for installing and using electric equipment in bituminous coal mines.

(2) Portable electric mine lamps.

(3) Storage battery locomotives for use in gaseous mines.

The Bureau of Mines have been made sole or joint sponsor on Sectional Committees to be formed for considering these three subjects and other member bodies of our committee have been asked to advise whether they are interested in these subjects, and therefore whether they wish to join the Sectional Committees as joint sponsor or simply as members to consider these proposed standards.

Sectional Committees for these subjects will doubtless be appointed at the present meeting of the committee.

The above list of important subjects, under consideration by our committee, are given simply to illustrate the present activity of the committee and to indicate the wisdom in having formed such a general committee to co-ordinate the work on mine standards being carried on by many different societies and organizations.

We are hoping through this Committee not only to direct Standardization for the mining industry, but to awaken in the member bodies a realization of the fact that through Standardization we can most easily and quickly carry out the national programs of Safety and Economy which these member bodies have been diligently fostering for many years.

MR. McGRATH: Has any one any suggestion to make upon Colonel Roberts' report?

As you will note from your program, the fifth general session of the Convention will convene here in this room at eight p. m. this evening

and you can all see that they have a very interesting program for tonight. I think that we all appreciate the excellent program that we had and the very instructive reports and papers that were submitted.

I wish to remark for a moment upon the paper presented by Mr. C. R. Thomas on popularizing being the same as standardizing. You gentlemen probably do not realize that as much as we do in the copper industry. Last March the copper industry realized that they had one year's unsold production on hand. So they closed down their mines practically in toto. I think there are only about three copper mines in the United States that are operating at the present time. They had a standard product but they couldn't sell it. The reason for that was the fact that during the war the government had issued instructions that all copper mines should reserve 50 per cent of their production each month for the consumption of the government. The copper mines reserved that 50 per cent and endeavored to sell the other 50.

About three months before the Armistice the government failed to take this fifty per cent, so on November 11, 1918, the copper mines had one and a half month's production which they had supposed was sold, and they had quite a lot of their other unsold product; but in the hope that peace would be signed and trade relations with Germany and Europe established, they went on producing. Of course, as we all know, that was not carried out and they found in March of last year that they had one million pounds of unsold copper.

The reason why they couldn't sell this copper after the armistice was the fact that the aluminum people, the steel people and other people had come in and supplied with their products the demand that the copper people had been unable to take care of by supplying 50 per cent of its production to the government.

So that now the copper people find that they must get back that trade and they have gone out to popularize their product and are instituting a method of propaganda and a campaign to educate the people to the value of copper.

For that reason the paper of Mr. Thomas appealed to me very strongly and I think will appeal strongly to everybody in the copper industry. Popularizing is about the same as standardizing, because if you don't popularize, there is not very much use in standardizing.

If there is nothing further, this meeting will now stand adjourned.

(The meeting then adjourned at 5 p. m.)

ADJOURNMENT

METAL MINING BRANCH

October 17, 1921, 2:30 P. M.

The first meeting of the Metal Mining Branch of the Standardization Division, Twenty-fourth Annual Convention of The American Mining Congress, convened at 2:30 o'clock, Monday afternoon, October 17, 1921, Mr. T. O. McGrath presiding in the absence of the general chairman, Mr. Chas. A. Mitke.

TEMPORARY CHAIRMAN McGRATH: Mr. Chas. A. Mitke, our General Chairman, being absent in South America on professional business, I have requested Mr. William B. Daly, Asst. General Manager, The Anaconda Copper Company, with whom most of you are probably well acquainted, to take charge of the Committee work, and the reports of the Committees during the coming sessions of the Standardization Conference.

(Mr. Daly then took the Chair.)

ACTING CHAIRMAN DALY: We all regret very much that Mr. Mitke is not here in person to handle this Conference. The purpose of this meeting today, as most of you who were present at the joint meeting this morning already know, is to try to get together to thresh out the reports of the Chairmen of the different sub-committees of this branch. I regret very much to state that some of the reports have not progressed as far as we would like. For this reason I believe the better method of procedure would be to take up and discuss each report as far as it has gone. Before proceeding further I shall call the roll in order to ascertain how many members of our various committees are present.

(A roll call indicated that owing to the unprecedented condition in the metal market very few committee members were in attendance. However, as a number of mining men, and visitors interested in mining subjects were present it was decided to discuss each report as it was read, in order to ascertain the opinions of mining men, other than committee members.)

REPORT OF CHAS. A. MITKE, CHAIRMAN GENERAL COMMITTEE

The metal mining branch of the standardization division at present consists of ten committees, covering the following subjects:

DRILLING MACHINES AND DRILL STEEL.
UNDERGROUND TRANSPORTATION.
FIRE-FIGHTING EQUIPMENT.
STEAM SHOVEL EQUIPMENT AND OPERATIONS.
MECHANICAL LOADING UNDERGROUND.
METAL MINE VENTILATION.
MINE TIMBERING.
MINE DRAINAGE.
METAL MINE ACCOUNTING.
WELFARE.

These are all subjects of especial interest to metal miners, not only in the states, but in metal mines the world over.

All of these committees are at work and making progress. While the progress made thus far is such that it does not readily lend itself to publication, nevertheless it is of the utmost importance in paving the way for the standards which the committees hope eventually to work out.

The standardization movement is not a matter for immediate decision, but rather a slow growth, the details composing the various units of standardization being worked out by engineers located in various mining camps throughout the country. In this connection it may be stated that there are general inquiries by the various departments of leading mining companies for simpler methods, a more economical classification of products, a reduction in the number of stages or routine, and an extension of the previous standards to much further dimensions. Naturally, these inquiries are largely in the nature of investigations, which are taken up and discussed pro and con before they can be crystallized into local standards.

The work of the Metal Mines Branch has been extended during the present year by the addition of two new committees on Metal Mine Accounting, and Metal Mine Drainage, both of the utmost importance to mine operators.

Both the Metal and the Coal sections of the Standardization Division of The American Mining Congress are working harmoniously with the American Engineering Standards Committee, the United States Bureau of Mines, and other mining organizations interested in the standardization movement. It is believed that this co-operation will be of the utmost importance when the time arrives for the formation of national standards and their adoption by the metal and coal industries.

As you are aware, commencing with January 1, 1921, there was a drastic curtailment of metal production, which resulted in the loss of employment to many members of mining organizations. Shortly after, there were complete shutdowns at many copper, lead and zinc mines. As a consequence, a number of our committee members have been forced to seek other employment, which has naturally retarded the work of standardization.

However, in spite of drastic curtailments, reductions of working forces, etc., such times as the present are the crucial occasions when it is most important to prepare for the future by the development of more efficient methods, and by standardizing present operations and equipment, in order to lower future mining costs.

It is earnestly hoped that in the near future there will be a revival of the metal business, and that during this coming year, each and every member of the committees of the Metal Mining Branch will personally assume the responsibility of making some individual contribution to the great standardization movement.

PROGRESS REPORT OF COMMITTEE ON MECHANICAL LOADING UNDERGROUND

I beg to submit the following report for the Committee on Mechanical Loading Underground for the current year. It was decided in November, 1920, by The American Mining Congress, to appoint a committee on loading machines for underground use. This committee was finally appointed and the organization completed by the first of the year. The work of the committee thus far has consisted in drafting a set of questionnaires to be sent to manufacturers and operators in order to determine the extent to which standardization of machines and fittings and standardization of methods of operation can be carried.

The first questionnaire, dealing with the standardization of parts of loading machines has been sent to various manufacturers; the second and third questionnaires, dealing respectively with mechanical loaders and with scrapers, have been sent to various operators with request for information as to methods of operation and results obtained. The returns from these questionnaires are incomplete, so that no report of results can be given at this time.

Signed by LUCIEN EATON, Chairman.

PROGRESS REPORT OF COMMITTEE ON MINE-FIRE FIGHTING EQUIPMENT

RESCUE APPARATUS

Mine rescue breathing apparatus is used primarily when it is necessary to penetrate dangerous atmospheres to save life, and also for the purpose of controlling underground fires. There are several types used in this country, as regards mechanism of construction, and the succeeding forms which have been made in recent years have resulted in types which have won the confidence of thousands of men who have been instructed to wear them. It is sufficient to state that rescue apparatus is now generally regarded as an essential part of a mine fire-fighting equipment.

The members of this committee are cognizant of the fact that very careful attention should be given to the selection of mine rescue apparatus, but no recommendation is offered suggesting the standardization of a particular type or types. It is agreed that an apparatus should not be used until it complies with the general requirements as recommended by the Bureau of Mines in Technical Paper 82, pages 23 and 24.

Apparatus are made in types to supply pure air to the wearer for a half-hour period and also for a two-hour period. The latter type is the kind principally used in mines for rescue and recovery

work, but both types are used in fighting underground mine fires. In deep mines, having openings extending considerable distance from outlets to surface, operators usually prefer to adopt the two-hour machine. There are mines in which fires have been sealed off and it has then been possible to operate the rest of the mine in safety. In instances of this kind, and others that may be cited, the half-hour type of apparatus may be used in preference in the larger and heavier type.

It is the concensus of opinion of the members of the committee that rescue apparatus meeting the Bureau of Mines' requirements, and providing the wearer with pure air for a two-hour period, is the most desirable machine, as a part of mine fire-fighting equipment.

Maintaining apparatus in first-class condition and thorough and systematic training of men are absolutely essential in order to insure its use with safety.

MECHANICAL RESUSCITATING DEVICES

There is always the possibility of lives being in danger when a fire originates in a mine, and a mine fire-fighting equipment is not complete unless there is utilized every laudable means to revive men who have become unconscious from inhaling smoke and gases caused by fire. The opinion of men in the medical profession, and also laymen as well, differ as to the value of mechanical resuscitation devices. Manual methods of resuscitation should be understood by fire fighters and the maintenance of the best types of mechanical resuscitation devices may not be objectionable, as a part of the equipment.

FIRE EXTINGUISHERS

The members of the committee suggest no preference relative to fire extinguishers but recommend that they be maintained at shaft stations, pump houses and other permanent underground locations where they will be accessible to quench fires in incipient stages. Frequent inspection must not be neglected.

FIRE HOSE

The committee suggests the advisability of standardizing on air hose, as pipe lines and air hose are always available for fighting fires, and to convert air lines to water lines is merely a matter of manipulating valves. A complete special water system for fire purposes from surface into underground openings is preferable in mines having a high fire hazard. Air hoses with drawn pipe nozzle in one end for this system should be kept at shaft stations, pump stations, etc.

FIRE PROTECTION AT COLLAR OF SHAFTS

The committee advise the maintenance of fire hose and hydrants close to the collar of shaft. In shafts carrying dry

timber a water spraying system is considered a very effective device. Steel head-frames and concrete shafts are the best security against fires..

BULKHEAD MATERIAL

Material for building bulkheads, such as posts, planks, sand, etc., should be kept stored underground, so that it can be utilized to advantage in localizing a fire by construction of bulkheads. Openings vary in size and no recommendations are offered on standardization.

PORTABLE BLOWERS

Due to lack of information relative to the advantage of using portable blows in fighting mine fires, the committee offers no suggestion.

STENCH SYSTEM OF ALARM

The committee offers no recommendations on this subject at this time.

Signed by WM. CONIBEAR, Chairman.

In the discussion which followed the reading of the report, it was suggested that a cement gun be included in the list of fire-fighting equipment, for building bulkheads.

The recommendation of the Committee that chemical fire extinguishers be installed underground, in shaft stations, met the approval of those present.

Written comments were received from Mr. Guy J. Johnson, Safety Inspector of the Homestake Mining Company, and Mr. Orr Woodburn, Director, Globe-Miami District Mine Rescue and First Aid Association, both members of this committee.

In regard to Resuscitation Devices, Mr. Johnson writes:

"As we recommended last year against mechanical resuscitation and in favor of manual methods, so I am still in favor of doing."

Mr. Woodburn, on the contrary, states:

"It would seem a very narrow policy to recommend the elimination of mechanical devices. The world over, men prominent in the medical profession and practically every hospital, are continuing to use mechanical devices and seem to favor them more every year."

In regard to Portable Blowers, Mr. Woodburn also states:

"The Butte District has pioneered the portable blower possibilities and can give the most authentic information. The Copper Queen Company at Bisbee, Arizona, has a disc type blower mounted on a truck and operated by storage battery on another truck. It was in use several years ago but cannot say what their conclusions were regarding its use. At present this district has but one blower for the exclusive use of fire-fighting and the electric cable reel for it has not been completed. The cable is with it and it can be used quickly. It is a 30 inch disc type with a one HP motor direct connected. The unit is mounted on a truck. To a plate around the housing, pieces of heavy canvas are fastened. These places overlap and have eyelets in the outer edges so that it is a simple matter to close a timbered drift around the fan. The fan is kept on the surface adjacent to a fire proof shaft. Many other small complete units are in and out of use constantly that are available for fire use and could be used on short notice any time."

DISCUSSION OF PROGRESS REPORT ON MINE FIRE-FIGHTING EQUIPMENT, BY THE GENERAL CHAIRMAN, CHAS. A. MITKE.

The use of the portable blower has been so extensive in mine fires in the Southwest that it has amply demonstrated its value as a necessary adjunct to fire fighting equipment. This type of blower was used successfully at the mine fires which occurred at the Lowell Mine of the Copper Queen branch of the Phelps Dodge Corporation, Bisbee, Arizona; the Clay and Coronado Mines of The Arizona Copper Company at Morenci and Metcalf, Arizona, and at the fires which occurred some years ago at the mines of the Cananea Consolidated Copper Company, in Sonora, Mexico. In some of the above instances, the fires were fought successfully without the use of helmets at all. Such a step, however, is not recommended for general practice. It is better to have helmets on hand and available in case of emergency. Where the portable blower is used, helmet crews are only needed for scouting, and to be kept in readiness in case any man should be overcome with gas while engaged in fighting the fire. There is a notable advantage in using portable blowers as a great deal of work, such as building bulkheads, timbering, drawing chutes where necessary, laying water lines, putting up electric light wires, etc., formerly done by men with helmets, is now performed by miners. They are able to work in the fresh air coming from the blowers and perform their tasks much more rapidly than men encumbered with the apparatus.

It was suggested at the Chicago meeting that a cement gun be included in the list of fire fighting equipment, for the purpose of building bulkheads. In this connection, Acting Chairman Daly mentioned the success attained with this apparatus in the mines in Butte. It has not, however, been very successful in the Southwest, mainly for the reason that where the fires have occurred it has been very much easier, and time has been saved, by building the bulkheads by hand, rather than to bring the cement gun equipment in from the outside, pass it through narrow drifts, and finally set it up in a convenient place. Moreover, the quantity of cement used on our bulkheads is so small that a very few sacks of cement and sand are sufficient. We rarely use more than a ⅜" to ¾" covering of cement on our bulkheads.

The character of bulkhead used in practically all cases in this part of the country is made in the following manner: First, stulls are put up; then 2" boards are nailed on the stulls; following this, metal lath, chicken wire, or wood lath, is nailed on the 2" boards; finally, from ⅜" to ¾" thickness of cement is put on by hand. Such bulkheads are easily and quickly constructed, have been used at some of our most serious mine fires, and have stood the test well, as regards gas pressure or leakage. The use of these bulkheads has been a very great factor in reducing the cost of fighting mine fires. In practically every case these bulkheads have been constructed by men working in fresh air from portable blowers, and without the use of oxygen helmets.

PROGRESS REPORT OF COMMITTEE ON DRILLING MACHINES AND DRILL STEEL

Following the meeting in Denver last year it was decided to form an inner committee to work on the standardization of rock drills. This committee is composed of the following members, the first named being chairman:

Arthur Notman, Supt., Copper Queen Branch, Phelps Dodge Corp., Bisbee, Ariz.

Chas. A. Smith, Supt., Ray Con. Copper Co., Ray, Ariz.

H. Seamon, Drill Efficiency Engineer, United Verde Copper Co., Jerome, Ariz.

Frank Ayer, Supt., Montezuma Copper Co., Nacozari, Sonora, Mexico.

L. C. Bayles, Chief Engineer, Ingersoll Rand Co., Phillipsburg, N. J.

Geo. A. Shaw, Efficiency Engineer, Denver Rock Drill Mfg. Co., Denver, Colo.

H. T. Walsh, Vice-Pres., Sullivan Machinery Co., Chicago, Ill.

Geo. Gilman, 125 Prescott St., E. Boston, Mass.

In making these appointments it was with the idea that the first four should act on behalf of the operators, while the latter four should represent the manufacturers. It was believed that in this manner the work of standardization could be advanced more expeditiously than by leaving the matter entirely in the hands of this committee. It was thought that the representatives of the rock drill companies would take the lead in these investigations, being naturally more familiar with the requirements of the trade, etc., and they immediately signified their willingness to so act by exchanging ideas and blue prints covering certain points under discussion. In submitting this report I shall quote quite freely from the opinions expressed by the members of this committee, the first being an extract from a letter of an official of one of the drill companies, who wrote:

"There is one thought that has occurred to us, and that is we should like to have this discussion on standardization confined to the prominent drill manufacturers. . . . In going over a tabulation of the air hose, water hose and tank connections of the different companies, there is a slight difference in practically all of them which at present defeats interchangeability. If we are going to get together on a general interchangeability, I feel that we must all be willing to give and take, and with such a procedure it is going to mean a certain amount of loss to all of us. . . . It will be an advantage in time for all the drill manufacturers to have interchangeability of connections, but it is going to represent not only money loss but a good deal of trouble to inaugurate. The drill manufacturers might get together and decide this matter of connections for themselves, but as we have expressed a desire to act in conjunction with your committee, I feel that it would facilitate matters if we could confer with you at the time of our joint meeting."

The first matter taken up by the different drill manufacturers was the question of a hose connection. As to what conclusions have been arrived at by them I am not advised, but anticipate that they will be submitted in a separate report. I have not met with this inner committee, as at first proposed, believing that it would be better to postpone such a conference until the meeting of The American Mining Congress, when it could be taken up as part of the routine work of this meeting.

A year ago certain questionnaires were sent to the different

mining companies, asking for information as to their drills, etc. These have been tabulated, as per the attached blueprint. I would like to call the attention of drill manufacturers to the fact that most of the larger mining companies are not using couplings manufactured by the rock drill concerns. I cannot help but think that the rock drill manufacturers should be able to get together on couplings, and I believe this also applies to other accessories of rock drills, such as the openings into water tanks in use with Leyner machines, etc. As I understand, no attempt has been made so far to standardize the size of bolts and nuts about the machines.

As to the advisability of trying to standardize the machines themselves, I shall quote from a letter from Mr. Ocha Potter, a member of my committee, as his views are representative of one branch of the correspondence which I have received:

"The question as to the standardization of drilling machines is, to my mind, a debatable one. Conditions in various lodes are so different that it hardly seems practicable to me to devise anything like a universal machine that would be satisfactory. Competition among drilling machine manufacturers is so keen that the larger mining companies, at least, are at present able to get anything that they think desirable in the way of drilling machine equipment. In our own case, we find that machines that are adaptable to our conglomerate, which is very hard and fitchery, are not at all suitable to our amygdaloid mines, which are just the opposite in character.

"You will note from the figures inclosed that the change in gauge on the amygdaloid is only 1/32 of an inch for a 22" drill steel run, whereas on the conglomerate there is a change of 1/16 of an inch for each 9" drill steel run. As a matter of fact, we have had a drilling machine in operation for over six months on our amygdaloid, drilling holes up to 15 ft. in depth, with no change whatever in gauge. Such practice on the conglomerate, however, would be absolutely impossible.

"As far as possible, this Company has already standardized its drilling machine practice, and the machine now used for any particular operation is the one that has been found most economical for that particular purpose. There are, however, mines in this same district whose conditions are such that our drilling machine practice would be impracticable for them. So far as the mines in the Iron Country are concerned, judging from my own personal observations only, I am confident that their conditions justify a still different type of machine."

Along the same lines Mr. H. Seamon, another member of my committee, says:

"Subjects such as the advisability of a lighter drill, etc., are properly included, but the greatest field seems to be in the standardization of accessory equipment."

Referring to the blueprint summarization of questionnaires, it will be noted that there is a wide diversity of opinion on some matters. Question 1 shows a majority in favor of standardizing the water drill only. In Question 2, as to the size of the drill bar, one-half of the members do not believe it is possible to standardize the size of the bar, while those who do vary in their opinions from 3" to 3½". In No. 3 the type of drifting machine is almost standardized as the water leyner type. No. 5 shows

the stoping machines to be nearly all stope hammers, and most of the members think that the wet stoping drill is only a matter of time. In No. 7 the jackhammer type is used almost entirely for plugging. In No. 12 it appears that the spray for stoper drills is considered non-effective, and is unpopular with the men. As to the ideal weight of machines opinions vary greatly, as shown by Question 15, varying from 45 to 165 lbs. It is not necessary, however, to discuss each questionnaire here, as an inspection of the blueprint will disclose the various opinions. I wish to state in passing that I believe such sheets, if carefully prepared from time to time, would be of value to the mining industry and would tend to standardize the work of drilling, as they plainly show the practice of the different companies, and any advance noted thereon would soon be adopted by other companies. It must be realized that before standardization can take place a demand for it must be created among the mining companies themselves, and anything we can do to bring this about will be of vital assistance.

DRILL STEEL

Coming now to the question of drill steel, it will be noted in the questionnaires submitted that 1¼" hollow round steel is used by most of the mining companies for drifting, with but one company using hollow 1¼" octagon and another 1" and ⅞" hollow hexagonal steel. Question 23 on stoping shows that a variety of steel is used, with a tendency toward wet machines using ¼" octagon, while the jackhammers use ⅞" hollow hexagonal almost exclusively. It would thus appear that the companies are very close to a standard on steel already, and the question of the size of the hole is the debatable point among the operators.

The committee has had a paper from Mr. Charles S. Hurter, of the Du Pont Company, on "The Effect of Cartridge Diameter on the Strength and Quickness of High Explosives," which I consider of such importance that I recommend its publication in full herein.

Our own experience at the North Butte mines is in line with the work of Mr. Hurter, this company having done a great deal of experimentation on rock drill rounds. We have found that in drifts and crosscuts the 1¼" powder gives the best results, though in stoping where we have two faces to break to we have gone to ⅞". In this connection I quote Mr. L. C. Bayles of the Ingersoll-Rand Company, as follows:

"If it cost nothing to drill a hole, then one would only to have to consider the most desirable size from the standpoint of the explosive. But the cost of a hole advances about as the square of the diameter, and the point is soon reached when the increased cost becomes more than the increased efficiency of the explosive. It takes more steel to form large bits and it takes the blacksmith longer to resharpen them.

(True, this is not much, but nevertheless it amounts to something.) Then it takes the miner longer to drill the larger holes."

There is one point in Mr. Bayles' statement which I think should be a little more explicit, and that is whether he means the cost of just the time the drill is running, or whether he has allowed for the idle time which a machine is usually run in drilling operations. Our own experience shows that a drill is in actual operation not more than two hours out of eight hours during a shift, and that the rest of the time is spent in loosening and tightening bolts, changing drill steel, etc. Allowing for this time would, of course, bring the cost of the whole below the square of the diameter. Several companies report experiences along the lines suggested by Mr. Hurter, and I quote from Mr. Arthur B. Foote of the North Star Mines Co.:

"The North Star mine is all in hard rock so that drilling and blasting are the two largest factors in the cost of mining. During experiments, with the object of increasing the speed of drilling, an attempt to attain increased speed was made by reducing the diameter of the drill bits to such an extent that it was necessary to use 7/8" diameter powder in the bottoms of the holes. It was found that it was impossible to break the ground satisfactorily with this size powder."

And in this connection also Mr. George A. Shaw of the Denver Rock Drill Mfg. Co. states:

"While we have never been able to conduct any experiments on the proper size to which a hole should be drilled, we have been able to note the average trend of bit sizes through the equipment ordered for drill sharpeners. While there was a tendency a few years ago to reduce the size of the hole drilled to a minimum, this practice seems to have greatly lost favor and I think there are very few bits made at the present time smaller than 1¼" or 1⅜" for deep holes. This would not apply, of course, to short holes for block-holeing and possibly to a great deal of stoper work for raising, etc."

It is apparent from the above reports that most of the mining companies will use either 1⅛" or 1¼" powder in a large part of their work. However, the question of standardizing the number and sizes of drills and drill bits will vary with each mining camp, owing to the nature of the ground encountered. I think this difference is shown in Question 22, and I do not believe that the "whims" of mining superintendents are accountable for it. In some cases the starting size varies from 1⅞" to 2½", and I believe a great many of these sizes have been determined by actual practice, and represent the best results obtained. Mr. Chas. A. Smith of our committee did not find his experiments with a small sized starter satisfactory, and states:

"We have done some experimenting with the Carr Bit in the effort to reduce the size of the hole at the collar, but our efforts have not been very successful. We seem to get better results by using larger steps between the bits and making the holes correspondingly larger at the collars."

At the North Butte properties an endeavor has been made to

use standard rounds in the drifts and crosscuts, as well as in stoping. In making these rounds the ground has been classified into five divisions: Extremely Hard, Hard, Short, Medium and Soft. The selection of the card to be used depends upon the judgment of the shift boss. Attempts were made to find some method of classifying the ground by tests of hardness, but so far we have found no method of determining the breaking quality of different grounds. Numerous tests have been suggested, but do not work in actual practice. Until some such standards are discovered the question of breaking ground at the mine will always remain in the hands of the foreman and be a matter of experimentation. It is evident that once they are worked out for any mine, they can then be followed indefinitely.

In conclusion, "Standardization" may be said to be the "establishing of any type, model or measure by general usage and consent." On such points, therefore, as the members of this committee have reached a practical agreement, standardization may be said to be nearing realization, while as to those showing views far apart further discussion is recommended.

Signed by N. B. BRALY, Chairman.

THE EFFECT OF CARTRIDGE DIAMETER ON THE STRENGTH AND QUICKNESS OF HIGH EXPLOSIVES

By CHAS. S. HURTER

As one of the explosives members of the committee on Drills and Drill Steel and as a representative of an explosives company, the writer, in common with practically all fellow members of the explosives business does not look with favor on any change in drills that will lead directly or tend to lead to a reduction in the diameter of the high explosives cartridges in common use. The manufaeture of small diameter cartridges is more expensive than the manufacture of the larger diameters, and according to the research results we have at hand—incomplete, it is true—the use of small diameter cartridges is uneconomical for the consumer because they do not develop the full explosive strength of the dynamite used.

In the days before the stoping drills and other hammer drills were invented, 7/8"x8" cartridges were used in hand-drilled holes, nitroglycerin dynamite was the general rule, holes were rarely over three feet deep, and little or no trouble was ever experienced in blasting. At the present time machine drills, particularly those of the hammer type, have made is possible to drill much deeper holes and ammonia dynamite and gelatin, which have many superior features but are both more insensitive than nitroglycerin dynamite, have almost completely replaced the latter in underground work. Under these conditions the diameter of the cartridge has become an important factor in determining the execution to be secured from a given weight of explosive.

It is my purpose to set before you here some evidence which shows that the detonation wave, whose characteristics closely resemble those of a sound wave, is transmitted more freely, with greater strength and violence, that is, as the cartridge or charge diameter increases up to certain limits, these depending upon the natural sensitiveness of the explosive in question. And in passing let me say that fifteen years' experience in the practical use of explosives has proved to my personal satisfaction that cartridge and charge diameter should be as close to the same as is practical; that is, that better results are obtained from a blast when cartridges are used that fit the bore hole fairly closely than when smaller cartridges are mashed up with a tamping stick in the bore-hole in an attempt to fill it.

Probably no man ever lived who did more work on explosives from the standpoint of scientific research than the late P. E. M. Berthelot, the famous French chemist. To him we are indebted

for most of our information in regard to the nature of the detonation reaction, its means of starting and propagating and its other characteristics. In the course of his researches he discovered that under adverse conditions, an explosive can detonate in a manner that does not give its maximum strength and shattering effect, and conversely, two facts that have a most important bearing on the question in hand: First, that in a given explosive, the maximum strength or explosive effect is obtained or the detonation is most complete, under conditions when the explosive detonates with the greatest violence, that is with the greatest quickness; and second, that the smallest quantity of deleterious fumes are given off by any explosive when the detonation is most complete.

Now, just as maximum strength is coincident with quickness of detonation, so quickness of detonation, in a given explosive, has a direct relation to its sensitiveness. Consequently tests of the sensitiveness of dynamite in cartridges of various sizes give some indication of the effect of diameter upon quickness and upon strength. The standard sensitiveness test consists in cutting a cartridge in halves, priming one half with a No. 6 blasting cap, rolling the two halves, with the cut ends facing each other, in a sheet of the same paper as is used to line dynamite cases to form a tube of three thicknesses of paper, lighting the fuse, exploding the unprimed half by propagation and repeating the experiment with increasing distance between the half cartridges until it has been ascertained what the maximum distance is at which the primed half will explode the other half.

The following results of sensitiveness tests were taken at random from the experimental files of the Eastern laboratory of E. I. Du Pont de Nemours & Co.

By Chas. S. Hurter

Grade	Size	Temp. F.	Sensitiveness
60% Low-freezing Ammonia	1¼"x8"	70	20"
60% Low-freezing Ammonia	⅞"x8"	70	8"
60% Low-freezing Ammonia	1¼"x8"	0	7"
60% Low-freezing Ammonia	⅞"x8"	0	0"
40% Low-freezing Ammonia	1¼"x8"	70	12"
40% Low-freezing Ammonia	⅞"x8"	70	5"
40% Low-freezing Ammonia	1¼"x8"	0	3"
40% Low-freezing Ammonia	⅞"x8"	0	0"
*62% Gelignite (75% Gelatin)	1¼"x8"	70	18"
*62% Gelignite (75% Gelatin)	⅞"x8"	70	12"
* Blasting Gelatin	1¼"x8"	70	11"
* Blasting Gelatin	⅞"x8"	70	6"

They show the propagation distance to be in every case greater with the larger diameter cartridge. They also show the effect of chilling on the two sizes, namely, that it produces greater insensitiveness in the smaller sizes.

* Average of 10 mixings each.

In general with cartridges of the same size, the greater the propagation distance, the greater is the sensitiveness of the dynamite. In comparing cartridges of different sizes, however, another element which enters into the reaction must be taken into consideration. The large quantity of explosive in the larger diameter cartridges tends in itself to increase the distance at which propagation will take place. It has been established by **Berthelot that the distance over which shock is effective varies directly as the quantity of initial explosive, and that the intensity of the shock transmitted varies inversely as the square of this distance.

Therefore we cannot take the propagation distance alone as a measure of sensitiveness and strength but must consider in conjunction with it the velocity of detonation or quickness of the dynamite. Here follow the results of some tests made by the Hercules Powder Company.

Grade 20% Straight Nitroglycerin Dynamite

Diameter of Cartridge	Velocity of Detonation
⅞"	7500 ft. per second
1"	7800 ft. per second
1¼"	8380 ft. per second
1½"	8880 ft. per second

Grade 30% Low-Freezing Ammonia Dynamite

⅞"	7200 ft. per second
1"	7500 ft. per second
1¼"	9500 ft. per second
1½"	10250 ft. per second

These figures show that the velocity of nitroglycerin and ammonia dynamite increases steadily with increasing diameter.

I do not lose sight of the fact that gelatin is the explosive most widely used in metal mines, but laboratory tests of gelatin are very unsatisfactory as it has a totally different action when shot unconfined than when it is properly confined in a bore-hole. When confined, gelatin has from two and one-half to three and one-half times the quickness or smashing effect, according to the strength used, than it has when unconfined. The following table gives the results of some velocity tests made with Du Pont low-freezing straight gelatin and this is about the only experimental data available on gelatin. These tests were made unconfined in the open air.

**See Berthelot "Explosives and their Power," Chapter "Explosives by Influence"; also "Lake Superior Mining Institute Transactions," 1917, article on "Blasting Explosives and their Accessories."

Grade	40% DuPont			60% Du Pont		
Size of Cartridge	⅞"x8"	1¼"x8"	1⅛"x8"	⅞"x8"	1¼"x8"	1½"x8"
Density	1.68	1.72	1.69	1.61	1.80	1.636
Velocity—1st cartridge Ft. per second	7376	7777	8475	8636	8944	8803
Velocity—2nd cartridge * Ft. per second	7724	8013	8817	8495	9407	10810

These figures go to show that the action of gelatin is more violent and more complete with large diameter cartridges than with small.

On this subject of cartridge diameter as affecting sensitiveness and velocity the Bureau of Mines wrote us as follows:

"In general it is believed that explosives of the same class, grade and density have a lower rate of detonation and are less sensitive to the propagation of the explosive wave as the diameter of the cartridge decreases. Tests by the Bureau confirm this. Tests made on Grade 11 TNT by the Bureau confirm the statement regarding sensitiveness. Many tests by the Bureau confirm the statement regarding rate of detonation."

From all this evidence it seems clear that the quickness and sensitiveness of dynamite, and consequently its strength, increase with the diameter of the cartridge, in short, that the explosive reaction is more complete and approaches closer to the calculated theoretical reaction in large diameter bore-holes than in small ones. This conclusion must be qualified, however, as provided for at the outset, by the knowledge that strength and quickness increase with increasing diameter only up to certain limits. The only research work that has been done to ascertain what these limits are is that of Berthelot on just one explosive, namely, the European dynamite No. 1, which is made up of 75% nitroglycerin and 25% kisselguhr. While the incombustible absorbent renders this dynamite no stronger than the American 40% explosives, its nitroglycerin content makes it one of the most sensitive explosives in use. Berthelot's tests showed that the maximum diameter above which no increase in sensitiveness was observed was about 1¾ inches. In the case of the more insensitive explosives, we know that the cartridge diameter corresponding to the greatest efficiency is considerably greater than this. With some of the extremely insensitive high explosives used in the recent war, it is 4 inches and even more.

On yet another ground, as previously suggested, the larger diameter cartridge has greater strength than the smaller; that paper and paraffin in the wrapper. For instance, a 50-lb. case is, it contains more explosive in proportion to the amount of

* In making velocity tests the full speed of detonation is not always obtained in the first cartridge of the line.

of 1¼"x8" low-freezing ammonia dynamite contains about 46.9 lbs. of explosive and 3.1 lbs. of paper and paraffin, while the same case of ⅞"x8" contains approximately 45.2 lbs. of explosive and 4.8 lbs. of paper and paraffin. In this connection it is well to note also that, disregarding paper, only half as much powder can be put into a bore-hole one inch in diameter as can be loaded in a hole one and one-half inches in diameter, the lengths of the charges being equal. The ratio is even less than this when the weight of the paper and paraffin is considered.

Returning to the second fact quoted earlier in this paper as established by Berthelot in regard to the detonation reaction, namely, that the smallest amount of deleterious fumes are given off when the detonation is most complete, we can now deduce from the data which has been set forth above that, inasmuch as the greater sensitiveness and quickness of the larger diameter cartridges causes them to detonate more completely than the smaller ones, they will give off a lesser quantity of harmful fumes. In addition to the less complete detonation of the small sizes, there is another cause which makes them produce a greater quantity of fumes than the larger sizes, namely, the larger ratio of paper and paraffin to powder in them. The oxygen balance is lower and hence the proportion of noxious gas, carbon monoxide after detonation is higher. In close work this is very noticeable. This defect of the smaller sizes might be corrected to a certain extent in some kinds of dynamite by changing the formula, but gelatin dynamite cannot be changed without reducing its efficiency. Consequently in badly ventilated or close places, the larger cartridges will mean better breathing conditions for the men.

Certain other factors which affect the quickness and strength of dynamite have also a direct connection with cartridge diameter, such as water-resistance, density, and suspectibility to freezing. Information on these properties has been secured direct from the records of the Eastern laboratory of E. I. Du Pont de Nemours & Co. The following results of some experiments made there go to show that water-resistance is a function of the size of the cartridge inasmuch as the smaller the diameter, the sooner will water penetrate the entire cartridge. Each line in the table below represents an experimental mixing of low-freezing ammonia dynamite, half of which was punched in 1¼"x8" cartridges and other half in ⅞"x8".

Percent Strength	Hours Immersed under Water	Hydrostatic Pressure in lbs. per sq. inch	RESULT ⅞"x8" D	P	F	1¼"x8" D	P	F
60	1	15	2	3	0	5	0	0
60	1	15	0	4	1	5	0	0
60	½	15	2	3	0	4	1	0
60	½	15	4	1	0	5	0	0
40	½	15	1	2	2	3	2	0
40	½	15	1	3	1	3	1	1

D—Detonation. P—Partial Detonation. F—Failure to Detonate.

The density of a dynamite also varies with the size of the cartridge. At the present time practically all dynamite is machine packed and the construction of the packing machines is such that the powder is always loaded to a higher density in small diameter cartridges than in the larger ones. Now, other things being equal, a high density is conducive to more rapid deterioration from leakiness and setting. It also tends to make the powder more susceptible to becoming insensitive through being chilled. The number of 7/8" diameter cartridges to the 50-lb. case is about 2½ per cent less than the number based on 1¼" diameter cartridges figured by the mathematical rule that the area of a circle varies as the square of the diameter.

The Eastern Laboratory has no data to illustrate that small diameter cartridges will freeze more rapidly than larger sizes but this is probably the case. At least the fact that the former are punched to higher densities than the latter means that they are a better conductor of heat or cold and this in itself is conducive to more rapid freezing and thawing. The less time necessary for a small diameter cartridge to chill through is a self-evident fact.

The manufacture of small diameter cartridges is, as was said in the beginning, more expensive than that of the larger sizes and this fact has some slight effect on the price of all sizes, for in calculating the production cost of any given size, the average packing cost for all sizes is used. Therefore if the proportion of 7/8"x8" and 1"x8" cartridges used becomes very large, it will cause a corresponding increase in prices to cover the higher average packing cost, whereas, if the general consumption of larger cartridges increases, it will correspondingly lower the average packing cost and hence the price.

In summation it may be said, then, that small diameter cartridges are more apt to give trouble than the larger sizes because of their lower sensitiveness, their greater loss of sensitiveness when chilled, their more rapid chilling or freezing and their poorer water resistance. At their best they introduce greater chances of failure to propagate, and this is important in actual work for fragments of rock or dirt frequently get between cartridges as they are loaded in a borehole which tend to decrease the intensity of the explosive wave and reduce the violence and strength of the explosive reaction. The explosive tests are naturally increased by anything that tends to prevent the full explosive force from being exerted. In the comparatively deep holes drilled by stoping drills, for example, it is often necessary at present to use a 60% explosive in the bottom in 7/8"x8" cartridges with, let us say, a 40% explosive in 1⅛"x8" cartridges farther out in the hole to complete the charge. The 60% dynamite in the small diameter cartridge is not giving its full explosive force. If the hole were large enough to accomodate

a 1⅛"x8" cartridge at the bottom, there would be two gains: first, the larger borehole would hold a greater quantity of explosive, and second, the explosive force of a 40% dynamite in the 1⅛"x8" cartridge would be fairly close to that of a 60% dynamite in a ⅞"x8" cartridge. Particularly is this true of the gelatin dynamite which is almost exclusively used in stoper drill holes.

For all these reasons and on the basis of wide investigation of results of using high explosives in small diameter cartridges the explosives companies are agreed in their recommendation that in holes over three feet deep it is best not to use cartridges having a diameter of less than 1⅛". In the West 1⅛"x8" is the standard size; in the East 1¼"x8".

STANDARDIZATION OF DRILLING MACHINES AND DRILL STEEL

By GEO. H. GILMAN

Basing my opinion upon the result of an analysis of the general Rock Drill situation, conducted on the strength of the summary of questionnaires that this committee now has before it, I believe it inadvisable for this committee to recommend the standardization of parts that enter into the construction of the Rock Drilling Engine proper, in view of the possible danger that such procedure will be contributory to a state of stagnation as applied to development, which neither the up-to-date manufacturer nor the mining industry desires.

The development of the Rock Drill has been slow, and it is today in a state of evolution. New models are constantly being developed that are superior from the operator's viewpoint to the machines which they will eventually supercede. In many cases it is merely the refinement of detail which determines superiority. Suggestions for improvement are always welcomed by Designing Engineers and such suggestions as those presented by Mr. Arthur Notman at the last annual meeting of the committee are especially valuable as a means of general guidance for the machine designers.

In the design of a Rock Drilling engine, weight of machine and general type are the major fixed stipulations. With a given weight and general type stipulation the designer must strive to secure maximum effectiveness and efficiency for the conditions of the work; and as cylinder diameter, weight of hammer piston, and length of stroke are the principal determining factors, the entire mechanism must of necessity be pyramided upon the design of the piston hammer motion. Suitable provision must be made for the automatic rotation of the drill steel, cushioning of the piston hammer, introduction of air and water for cleaning the drill hole, automatic lubrication of all working parts, feeding of the machine, throttle control, locking the drill steel in position, proper drill steel change, the adaptability of the machine to the

saddle of the support and many other minor features. In consequence of this and the present state of the art, designers must work in ounces and fractions of an inch, for which reason it is oftentimes impossible to conform to a set of fixed specifications that embody detail of design. Furthermore I believe the standardization of parts such as cradles, feed screws, crank handles, side rods, standard rods, oil plugs, water tubes, etc., would eventually prove to be disadvantageous to the users. Such parts, if it were possible to standardize them, would be thrown upon the open market and the drill manufacturers would, if they attempted to maintain the required standard of quality of product and field service that is now rendered the user, be forced to increase the price of such parts of the machine as they produce and market, in order to compensate for the loss in revenue from the sale of other parts that would probably be diverted to other channels.

Again I believe such procedure would work an injustice on the legitimate Rock Drill manufacturer, for if the user should resort to the expedient of equipping the vital parts of a machine of one manufacturer with less important parts of questionable quality of some other manufacturer, the upkeep cost of the machine might be greatly influenced adversely to both the user and the manufacturer of the vital parts of the machine.

I therefore suggest that this committee restrict its endeavors to the standardization of the following:

(1) Types and sizes of Rock Drilling Machines.
(2) Names to designate the different types and sizes of machines.
(3) Drill Steel for use with these machines.
(4) Hose and hose fittings.
(5) Mining columns or bars.

I offer as a suggestion that this committee standardize the names of different types of machines. Machines should be given names descriptive of something connected with the kind of work for, or the way in which they are commonly intended to be used, and machines of the same name should be distinguished according to whether they are wet or dry, mounted or unmounted, have feed screw or air feed, piston ratchet or motor rotation, and the type of drill shank with which they may be used, or by some other distinguishing characteristic.

Machines should not be given names already adopted by manufacturers as trade names, for the reason that such names are the exclusive property of such manufacturers and who, therefore, can prevent others from using them. It would be futile for this committee to try to induce all manufacturers to use the same name for a given type of machine when that name has already been appropriated by one manufacturer and who, if he is zealous of the right the Law confers on him, can go into the Courts of Law to prevent its use by anyone except himself.

It is unfortunate among the users of Rock Drills that some of

the trade names employed by certain of the Rock Drill manufacturers have become established as designating certain definite types of machine. It will be impossible for the committee to employ them because their adoption by other Rock Drill manufacturers is precluded. Obviously under this condition, it remains for this committee to suggest and endeavor to have adopted other names. For example, it will not be disputed that among the users of Rock Drills, the name "Jackhammer" indicates a distinct type of machine. This name is used as a trade-mark by a certain manufacturer and the right to use it rests exclusively with such manufacturer. According to the law of trade-marks, no other manufacturer can use this name or any name so similar thereto as to be liable to be confused therewith.

To ascertain the trade names used by the various Rock Drill manufacturers, it is suggested that the committee request the various manufacturers to furnish this committee with a list of their trade names used for Rock Drill.

I have endeavored to formulate names for the different types of Rock Drilling machines commonly used in mining and as a result submit for a basis of discussion the following:

HEAVY DRIFTER—A two man mounted hammer drill used for heavy drifting and tripod work.

LIGHT DRIFTER OR BREAST STOPER—A one man mounted hammer drill used for breast stoping, light drifting and tripod drilling.

HEAVY HAND HAMMER OR SINKER—An unmounted hand held hammer drill used for heavy blast hole drilling in shafts, open pit mining, and deep hole drilling in quarries.

MEDIUM HAND HAMMER OR BLOCK HOLER—An unmounted hand held hammer drill of medium weight used for block hole drilling in boulders, light blast hole drilling in stopes, quarry work, etc.

AUGER HAMMER—An unmounted hand held hammer drill having a high rotation torque and a comparatively light percussive action. Used for blast hole drilling in hematite iron ore, hardpan, gravel and soft rock formations.

LIGHT HAND HAMMER—An unmounted hand held hammer drill of minimum weight, used for scaling walls and hitch cutting from ladder or staging, light pop-holing, etc.

OVERHEAD STOPER—An air feed overhead stoping drill used for overhead drilling in stopes, raises, and for roof work.

In the event of the adoption by this committee of the names suggested in the foregoing, I offer as a further suggestion that the queries of the questionnaires as acted upon by the various mining concerns to whom it was sent, be modified to conform with the following:

SUGGESTED WORDING OF QUERIES TO QUESTIONNAIRES

(1) Scope. Shall the committee confine its investigation to the standardization of the water drill, or to both this and the dry drill?

(2) Is it possible to use but one diameter of column or column arm? If so, what size?

(3) What kind of drifting machine incapable of being unmounted and hand held do you use? State make and type.
(4) How many of each?
(5) What kind of stoping machines do you use? State make and type.
(6) How many of each?
(7) What kind of hand held hammer drills do you use? State make and type.
(8) How many of each?
(9) How many hand held hammers are mounted? Unmounted?
(10) How many air feed overhead stopers do you use and how many of these employ water for cleaning the drill hole?
(11) How many unmounted hand held hammer drills do you use and how many of these employ water for cleaning the drill hole?
(12) How many overhead stopers with air feed do you use equipped with sprays to lay the dust?
(13) How many hand held unmounted hammers do you use equipped with sprays to lay the dust?
(14) In your opinion, what is the maximum permissible weight of drifter for approximately 90% of the ground in your mine?
(15) In your opinion, what is the maximum permissible weight of unmounted overhead stoper with air feed, for use in your ground?
(16) In your opinion, what is the maximum permissible weight of the unmounted hand held hammer for use in your ground?
(17) In your opinion, is it possible to build a machine to take the place of both your drifter and unmounted hand held hammers?
(18) What is the maximum permissible weight for such a machine?
(19) Has your company conducted experiments to determine the practicability of using the same machine for all kinds of blast hole drilling except overhead stoping, by adapting a hand held machine to a mounting?

STEEL

(20) What kind of lugged shank hollow drill steel do you use? State cross section and percentage of each kind.
(21) What is the diameter of the hollow steel used under query 20?
(22) Same as query in questionnaire.
(23) What kind of steel is used with your unmounted air feed machine for overhead stoping? State cross section and percentage of each kind.
(24) What is the diameter of the steel used under question 23?
(25) Same as query in questionnaire.
(26) Do you use solid or hollow steel with your unmounted hand held machines? State cross section and percentage of each kind.
(27) What is the diameter of the steel used under question 26?
(28) Same as query in questionnaire.

HOSE AND HOSE FITTINGS

(29) Same as query in questionnaire.
(30) Same as query in questionnaire.
(31) What makes of connections do you use?
(32) Same as query in questionnaire.
(33) Same as query in questionnaire.
(34) As the present trend seems to be towards the use of the water drill exclusively, would it be advisable to try to make the standard water drill hose coupling adopted as standard, applicable for use with the dry machine?

DRILL STEEL

I offer as a suggestion that drill steel be standardized as to cross section of the body, type of shank, change length, and gage diameter of cutting end for the different change lengths.

It is obviously impossible to adopt a uniform size and shape of drill steel that will conform to the requirements of the different types and sizes of rock drilling machines. However, I believe it thoroughly practicable to restrict the number of types of drill steel to three or possibly five and satisfactorily meet the requirements of 95% of the rock drilling work encountered. Accordingly I offer for consideration by this committee, the following:

(1) A 1¼" round hollow drill steel equipped with a 1¼" round shank lugged 3⅛" long, having a change length of 24" with a minimum drill bit gage diameter of 1 7/16" and a gage variation of 1/16" for the various change lengths.

Applicable to the heavy drifer.

(2) A ⅞" quarter octagon hollow drill steel equipped with a ⅞" quarter octagon collared shank 3¼" long, having a change length of 12" with a minimum drill bit gage diameter of 1¼" and a gage variation of 1/16" for the various change lengths.

Applicable to the light drifter or breast stoper, heavy hand hammer or sinker, medium hand hammer or block holer, light hand hammer, and the overhead stoper.

(3) A 1½" solid cruciform or a 1⅝" diamond section, twisted drill steel equipped with a ⅞" quarter octagon shank collared, 3¼" long, having a change length of 18" with a minimum drill bit gage diameter of 2" and a gage variation of ⅛" for the various change lengths.

Applicable to the auger hammer.

Without any attempt to precipitate discussion on the merits of the feature and based merely upon the present use of the anvil block type of chuck with which many of the rock drilling machines are equipped to permit the employment of plain shanked drill steel without collar or lugs, I offer as a suggestion that this committee recommend the standardization of the two following sizes of plain shanked hollow drill steel which will satisfactorily meet the requirements of the different machines when equipped with the anvil block chuck:

(4) A 1" quarter octagon hollow drill steel equipped with a 1" quarter octagon plain shank 7½" long, having a change length of 24" with a minimum drill bit gage diameter of 1 7/16" and a gage variation of 1/16" for the various change lengths.

Applicable to the heavy drifter when equipped with the anvil block chuck.

(5) A ⅞" quarter octagon hollow drill steel equipped with a ⅞" quarter octagon plain shank 6" long, having a change length of 12" with a minimum drill bit gage diameter of 1¼" and a gage variation of 1/16" for the various change lengths.

Applicable to the light drifter or breast stoper, heavy hand hammer or sinker, medium hand hammer or block holer, light hand hammer and overhead stoper when equipped with the anvil block chuck.

HOSE AND HOSE FITTINGS

As applied to the standardization of hose fittings, I wish to again present for consideration by the committee, the suggestion

submitted on the occasion of the last annual meeting and as my recommendations in this regard were fully described in the June 5, 1920, issue of the Engineering and Mining Journal, further description at this time will be unnecessary. I wish to state, however, that the type of socket joint recommended is readily adaptable to the present day models of rock drills without a material change being necessary and in construction it is of such a nature that its parts are adaptable to automatic turret lathe manufacture which has a direct bearing on cost of production. Every member of the committee is familiar with the cone joint of the ordinary pipe union and the suggested socket joint is but an adaptation of the other.

Upon request, I will be glad to furnish drawings illustrating the manner by which the socket joint coupling may be applied to its various uses in connection with rock drill service.

AIR AND WATER SUPPLY HOSE

It is suggested that specifications for air and water hose should be standardized in the following respects:

(1) Kinds of hose.
(2) Sizes of hose.
(3) Thickness of wall.
(4) Length of hose.

KINDS OF HOSE

For the air supply of drilling machines, it is recommended that this committee consider the standardization of (a) plain braided hose, (b) plain wrapped hose without wire winding, and for the water supply, corresponding wrapped hose of slightly thicker wall in proportion to inside diameter equipped with a covering of armor of half round galvanized steel wire 7/32" by 3/64" wrapped with a ¼" space between adjacent wires.

The sizes of hose should be standardized for the different drilling machines and it is recommended that the following sizes be adopted:

(1) Air supply hose of 1" inside diameter for the heavy drifter.
(2) Air supply hose of ¾" inside diameter for the light drifter or breast stoper, heavy hand hammer or sinker, medium hand hammer or block holer, auger hammer, light hand hammer and the overhead stoper.
(3) Water supply hose of ½" inside diameter for the water supply of all drilling machines.

A fifty-foot length of hose is recommended for the air supply and a twenty-five foot length for the water supply of all drilling machines.

With the inside diameter and thickness of wall established, the outside diameter may be determined. It is very desirable that the outside diameter be standardized in order to permit of the standardization of clamps and clamp bolts. It is therefore recommended that a minimum and maximum tube and cover thickness for the different sizes and grades of hose shall be established as follows:

Nominal Inside Diameter	Minimum Outside Diameter	Maximum Outside Diameter
Plain Braided Air Hose		
¾"—3 braid	1¼"	1 5/16"
1"—3 braid	1½"	1 11/32"
Plain Wrapped Air Hose		
¾"—5 ply	1 5/16"	1⅜"
1"—5 ply	1 5/8"	1¾"
Armored Wrapped Water Hose		
½"—7 ply	⅞"	1 1/16"

The wrapped hose comprises a tube of rubber, around which is wrapped a cotton fabric, the number of layers of which determine the ply of the hose. Usually if the hose is of 5 ply construction, there are four layers of fabric adjacent the tube, over which is a layer of rubber, the whole being wrapped with an outer covering of fabric. The purpose of the intermediate tube of rubber is to afford added protection against leakage in case of injury to either the inner tube or the covering. This type is sometimes referred to as double tube hose.

The braided hose comprises a tube of rubber, around which is braided or woven a series of canvas tubes, protected by an outer cover of rubber. Its construction necessitates a slightly higher selling price. In comparison with the wrapped hose it has the advantage of affording greater strength in proportion to the thickness of wall; the herringbone braid being without seam does not easily unwrap and withstands the effect of kinking much better than wrapped hose. The tough rubber cover applied to this type of hose is of great advantage in its resistance to abrasion and eliminates the necessity of wire wrapping or other armoring.

I question if it would be advantageous for this committee to recommend the standardization of tube and cover thickness for mining drill hose, as such specifications would be of no significance unless the quality of the rubber should also be specified. A thick layer of rubber properly compounded would be much more efficient than a thick rubber of inferior quality. Accordingly specifications would be of no value unless they completely covered the subject and described the construction and quality of the hose throughout.

Hose manufacturers do not as a rule place much emphasis on the thickness of tube and cover, owing to the fact that it is secondary in importance to quality, particularly the ageing quality of the rubber and also the oil resisting quality of the tube and the capacity of the cover to adhere to the fabric and to resist abrasion. These factors are largely a product of chemical compounding rather than the thickness and amount of material used.

Regardless of the fact that the American Society for Testing Materials has prepared specifications applicable to various kinds of hose, I believe it to be impractical for this committee to

recommend specific specifications to be followed by the trade generally in the purchase of mining drill hose. In the first place, manufacturers are constantly making progress in the development of improved construction so that any specifications that are acceptable to the committee might be out of date soon after their adoption. Furthermore, it would be difficult for purchasers to check up the manufacturer in order to determine if the specifications were conformed with, and such specifications could not justly be used unless accompanied by a thorough test. Rubber is an organic material and the problem is therefore quite different from that of metallic products, in that the physical and chemical tests involved are more elaborate and technical than the ordinary purchaser would be prepared to apply.

MINING COLUMNS, OR BARS

Pursuant to the standardization of mining columns or bars to meet the requirements of the standardized line of drilling machines, I suggest for consideration by this committee the following:

For the Heavy Drifter, a 3½" single screw column with 3½" arm when a single drill is employed, and a 4" double screw column with 3½" arms when two drilling machines are mounted on the same column.

For the Light Drifter or Breast Stoper, a 2½" single screw column with a 2½" arm when a single drill is employed, and a 3" double screw column with 2½" arms when two drilling machines are mounted on the same column.

By confining the standardization of columns and arms to the sizes specified, the committee will be enabled to restrict the number of mining saddles to two sizes, each of which shall be adapted to the 5" diameter cradle trunnion that is now generally considered as standard.

It is recommended that this committee consider the standardization of two different lengths of column arms for each size of column and that the length of the arm, measured from the center of the column to the extreme tip end, shall be as follows:

For the 3½" single screw column a short arm of 24" and a long arm of 30".

For the 4" double screw column a short arm of 24" and a long arm of 36".

For the 2½" single screw column a short arm of 18" and a long arm of 24".

For the 3" double screw column a short arm of 18" and a long arm of 30".

In the construction of all columns up to 7 feet in length, standard pipe is recommended for the body portion. For columns 7 feet and over in length, extra heavy pipe, except for the 2½" size of column in all lengths which should be made from extra heavy pipe.

When a standard length of column is specified, it will be understood to apply only to the closed or contracted length of

the column and that the length of pipe employed for the body portion shall be approximately 10" shorter than the specified length of the column.

It is recommended that there shall be included in the equipment of all columns, safety clamps corresponding to the number of arms with which the column is equipped and in addition an open end wrench adapted to fit the nut of all column bolts with its handle so formed that it may be employed as a jack bar.

PROGRESS REPORT OF COMMITTEE ON STEAM SHOVEL EQUIPMENT

The progress that has been attained by the Committee on the Standardization of Steam Shovel Equipment has not been as great as this committee had hoped for. However, it is believed that the subject in hand has been started in such a way as to make us believe that results should be obtained that will add materially to the present available data concerning steam shovel equipment.

The work has been conducted along the lines of determining standard types of steam shovels which in the light of past experience would meet all requirements of the mining industry, but has not as yet gone into that phase of the question ascertaining defects that have been noted by operators in the present type of shovels now on the market. The subject, however, covers such items of equipment as locomotives, cars, standard design of track, locomotives and wrecking cranes, drilling and blasting, etc.

This question of standardization of work is a matter of growth and development which may take several years before a final and complete report can be agreed to for presentation to the Mining Congress. This work of Standardization of Steam Shovel Equipment was started out with the thought that satisfactory progress could probably be made in the standardization of steam shovel equipment, as applied to certain work which such equipment has to perform, and the idea was to investigate by a form of questionnaire the different kinds of equipment used at the various mines and by contracting firms. With this thought in mind, on September 8, 1920, a request was made on each one of the members to outline a form of questionnaire that would cover this subject, which finally resulted in a tentative form, prepared on November 29, 1920, containing some forty-five questions.

It was believed that after answers to the questionnaire had been received that a general description of certain classes of work for which certain types of shovels, with their various equipment, would be suited for, could be stated.

A number of completed questionnaires have been received, but as all are not yet in the hands of the chairman, it is impossible at present to send a summary of the results.

Mr. T. A. Snyder of the Bucyrus Company, So. Milwaukee, Wis., has proposed a questionnaire covering the standardization of mine excavating machines. He has also included questions relative to electric machines.

It is the hope of the committee that by the next meeting of The American Mining Congress at least a summary of answers to questionnaires will be available for publication.

Signed by H. C. GOODRICH, Chairman.

PROGRESS REPORT OF COMMITTEE ON MINE VENTILATION

Owing to the fact that a number of mines are closed down, it was impossible to have any large number of the mine ventilating questionnaires, previously mailed out, filled in and returned by the various mining companies. The compilation, therefore, of data from this source, which would have been of considerable value to the committee in working out standards, was out of the question.

In lieu of the information mentioned above, as chairman of the committee on metal mine ventilation, I should like to submit the following principles for your consideration.

It is the earnest desire of your chairman that you will give each principle due consideration, denoting those which meet with your unqualified approval, and commenting on all those with which you are at variance, offering suggestions for amendment.

During the ensuing year it will be the object of the committee to expand these principles and enter into discussions of important details connected with ventilating problems.

No. 1.—That all working shafts be downcasts, smooth-lined, and fireproofed.

It is highly desirable that all working shafts be downcasts. Should any gas form in a mine (either from explosives, mine fires, or stratas generally) it naturally would seek its way to surface through the upcast shaft. Were the main working shaft an outlet, instead of an intake, it would greatly add to the danger, as a large number of the men would naturally endeavor to leave the mine by the main working shaft, (through which the gas was exiting to surface), rather than seek safety through some auxiliary and less familiar shaft. Moreover, there is always considerable work being done through the main shaft, and, if it is an upcast, the men employed in its vicinity are always at a disadvantage as they work continually in vitiated and impure air, which has already passed through a large proportion of the main workings.

In cases where sufficient shafts have been sunk on the property to take care of the entire ventilating system—both intake and outlet air—without using the main working shafts, then these latter may remain neutral. However, even in such cases, it is more desirable to make these shafts slight downcasts, in order to maintain a freshness in the air, and provide for emergencies in the event of possible mine fires, which might turn a neutral into an upcast shaft.

It has long been recognized that a smooth-lined shaft does not offer the same amount of resistance to the air currents, as that offered by the

ordinary timbered shaft. Experiments show that a very much larger volume of air can be passed through a smooth-lined shaft, than through an ordinary shaft, using the same amount of horsepower in each case. Smooth-lining may be accomplished by the use of ordinary boards, but such construction does not constitute a fire-proof shaft. The most satisfactory form of smooth-lining, which is also fireproof, is the concrete shaft. Another form of smooth lining and fire-proofing is the use of brick, or faced rock and mortar. Still another form, is the use of gunite and metal lath, also concrete slabs, which are placed flush with the shaft timbers and cemented in.

The value of fire-proofing main working shafts cannot be questioned, as numerous accidents have occurred in the past which have demonstrated the necessity of having all downcast shafts fireproofed, as an insurance measure against the loss of life and property.

If, however, the life of a shaft, or of the mine itself, does not justify the cost of a first-class fire-proof shaft, some other method of fire protection should be adopted. That most generally used, is the installation of water sprays (controlled from surface) in both the shaft and shaft stations. In addition to such a spraying system, a complete control of the ventilating currents on each level, by means of fire doors, must be provided. These should also be controlled from surface. Unless an absolute check of the ventilating current, by means of these doors, is obtained, the water from the sprays would, in the case of a shaft fire, force the smoke and gas into the workings.

No. 2.—The areas of all downcast working shafts should be large enough to permit a sufficient volume of ventilating air to pass through without an excessive velocity. Where working shafts are already in operation, other provisions must be made, but when the sinking of new working shafts is contemplated, this point should be borne in mind. As a matter of fact, in many cases, the areas of main working shafts are entirely too small for efficiency purposes, quite apart from the question of good ventilation.

No. 3.—In all downcast shafts, the cages should be provided with gratings on the bottom, in order to offer as little resistance to the air as possible, and the bonnets should also be made of screening instead of sheet iron, in order to allow air to pass through. The screening used, however, must be fine enough, and strongh enough, to avoid all danger from falling rock.

No. 4.—Provision should be made at all downcast shafts for fireproof head frames, such as steel or concrete, and all buildings adjacent to shaft collars should also be fireproofed.

No. 5.—As, in general, there is considerable air movement in all shaft stations, and as the majority of shaft fires have occurred in such locations, all stations should be fireproofed simultaneously with the shafts.

No. 6.—Where shafts are sunk for ventilation purposes only, such shafts should be circular and fireproof. The use of the circular shaft has been found through years of experience, to be preferable to the square or rectangular shaft, on account of its smaller perimeter for the same area.

No. 7.—The total outlet area of a mine should always be larger than the total intake area. Air entering a mine usually rises in temperature in its passage through the workings, thus increasing its volume. Therefore, the larger the final outlets of the mine, the less will be the resistance, and less power will be required to force the given volume of air through the workings.

No. 8.—It is advisable that the velocities in main operating shafts do not exceed 1500 feet a minute. This, however, does not apply to shafts which are used for ventilation only, and which are not used as traveling ways for men, as the velocity in these latter shafts may be much higher.

No. 9.—Wherever the mining method permits, the ventilating air should be drawn off on various levels, rather than forcing the entire volume down to the bottom of the shaft and allowing it to exhaust upwards through the workings. The former method will allow a more even distribution of air throughout the entire mine workings, with a great deal less friction than the latter. Moreover, in the latter method, where the air is carried to the lowest level before being split up, the entire volume is, first of all, drawn through restricted areas for great distances, which naturally results in the maximum amount of friction.

Secondly, the impurities and moisture taken up by the air in the lower workings are then carried upwards continuously, through all the upper levels, having not only a detrimental effect on the men, but keeping the upper workings in a moist and usually hot condition.

It has long been recognized that wherever possible, the division of a mine into separate ventilating districts, or air splits, is most advantageous. The currents of air, after being used to ventilate such districts should not be used to ventilate other workings, but conducted as directly as possible to the upcast shafts.

No. 10.—It is recommended that the metal mines be urged to adopt standard areas for tunnels, drifts, passage-ways, and raises, which, while conformable with economy, will permit the maximum flow of air, with the minimum friction.

The use of frequent raises, in ore bodies mined by practically every underground mining system, has been found to be most advantageous from an efficiency standpoint, as the greater the number of raises, the less the hand labor required in passing the ore, and the greater the efficiency. The use of such frequent raises should be encouraged, as they greatly aid the distribution of air and decidedly improve the general ventilation.

No. 11—So-called "abandoned workings" in metal mines, from which the ore has not been entirely extracted, or which have future prospect values, should be provided with some form of economical regulator door or stopping, which, while cutting off the major flow of air from entering these so-called "abandoned workings," allows sufficient air to pass through to prevent decay. Abandoned workings which are filled with waste, or cave of their own weight, and from which all ore has been extracted, require no ventilating air, and generally seal themselves. In rare instances, where worked-out areas which have no future value do not cave of their own weight, and contain no fill, they should be sealed off in order to conserve the ventilating currents.

No. 12.—In all new sections of a property, which are being developed for stoping purposes, the ventilation should be planned simultaneously with the stoping, and expanded along with the mining operations.

No. 13.—For many years, the coal miners of both Europe and America, have recognized the great importance of air movement, not only in main traveling ways, but also at the various working faces. To secure such movement at the working faces in metal mines is far more difficult than in coal mining. However, the real test of an efficient primary metal mine ventilating system is the number of working faces which are provided with adequate air movement. This can be obtained through judicious coursing of the air currents, by means of air connections advantageously located, the use of stoppings, ventilating doors, brattices, occasional overcasts, etc.

No. 14.—In general, all mines should be provided with a primary and a secondary ventilating sysetm. The primary ventilating system to consist of large mine fans, advantageously located according to local conditions, and, if efficient, to thoroughly ventilate from 75% to 95% of the workings. The secondary ventilating system to consist of small blowers

with ventilating pipe, for use in dead ends only, such as long drifts, raises, or stopes located in isolated sections of the mine.

The secondary ventilating system should never be allowed to supercede the primary ventilating system, as such procedure is not only inefficient but very costly. All efforts should be directed towards improving the primary ventilating system, in order to have it ventilate as much of the mine as possible.

No. 15.—The use of either pressure or exhaust systems cannot be standardized, but must be decided according to local conditions at the mine about to be ventilated. This also applies to the location of fans for primary ventilating systems. Certain conditions may require surface installations, while other mines may be served more adequately by fans installed underground. The design and size of fans, volume of air, and water gauge, all depend largely on local conditions.

No. 16.—In general, large mine fans should be reversible.

No. 17.—In mines which are so dry that dust is readily formed, spraying systems should be installed to lay the dust and humidify the mine air sufficiently to prevent excessive evaporation.

Signed by CHAS. A. MITKE, Chairman.

DISCUSSION

During the discussion, the advantages of smooth lined over timbered shafts was brought out by Chairman Daly, who stated that experiments had demonstrated that there was a notable decrease in friction where smooth-lined shafts were used.

In regard to sizes and dimensions of equipment for secondary ventilating systems, Chairman Daly stated that the Anaconda Copper Company uses the following equipment for general purposes in its mines:

5 H.P. single phase 2½ blower.
7½ H.P. 2/3 phase 2½ blower.
15 H.P. No. 4 blower.
Piping:
Distances of 500 ft. in length, 10" pipe.
Distances 1,000 ft. in length, 14" pipe.
Distances 1,000 to 2,000 ft. in length, 16" pipe.
Distances beyond 2,000 ft. in length, 16" pipe and relay blowers.

PROGRESS REPORT OF COMMITTEE ON MINE TIMBERING

Reduction in the cost of timbering may result from use of such methods of mining as avoid timbering or permit the use of smaller sizes, in the use of cheaper timber, from economies in the cost of handling and framing, avoidance of waste and saving in freight.

The question of mining methods may safely be left in other hands for the present, merely calling attention to the fact that timbering in stopes should be considered as merely a temporary support while some other method of holding the ground is provided, as by waste filling, or until the openings are abandoned to collapse, if they will, as in slicing or caving. Smaller sizes and cheaper timber can be used in such cases. In this matter rapidity of extraction is essential.

There can be no question of the advantage of standardization at individual mines. Much can be done of benefit toward standardizing chutes and manways, for square set, top slice or similar methods of stoping or for prospect raises. In such a wide

variety of design as may be found in different mines there are a few of good sound construction, any one of which could be adopted to advantage and eccentric practice avoided. The newer methods of caving are not yet sufficiently uniform, nor have they reached such stable routine that general standardization can yet be approached.

In stoping by square set in the West the usual horizontal section of a set is 5'x5', but the height often differs, ranging between 7½' to 8½'. In Michigan the horizontal section is often greater. The appropriate section would appear to depend on the safe area that can be opened, without more than occasional temporary stulling to support the roof, before the timbers are set. The height is limited by convenience in putting up timbers and in handling the ground safely. The consumption of timber is reduced by making the sets higher and wider.

There is such a wide range in the character of ground and occurrence of ore that variations in practice are neccessary and desirable. A simple method of framing, however, can and should be adopted for each size of timber that would be accepted as a standard.

Square setting is particularly referred to, as in that method timbering and framing is of greater importance than any other. The same principles which control square set timbering may be applied to top slicing whether flat or inclined.

In other methods of stoping the quantities of timber consumed are less and its use is apt to be either unsystematic or highly specialized.

The spacing of drift sets is usually five feet from center to center. They differ in section and in height and width according to the requirements of operation. A better relation should be established between the section of the post and the cap, depending on the height and the span. It is not infrequent to see caps used that are too weak for the posts. Beyond making sure that the sets are correctly designed and lengths used that cut to advantage from the timber available, standardization will not greatly affect drift timbering.

In shaft timbering a great variety of sections and details of framing are to be found. An attempt should be made to standardize the dimensions of shaft compartments. This is of less importance in the case of properties making large production since they can pay for special equipment, but would be of great benefit to the smaller operators. It will affect them less in economy of timbering and framing than in making possible the standardization of shaft equipment, cages, skips, etc. The framing of shaft sets should be of simple design, and after standardization no doubt framing machines will be developed, for shaft timbering.

The recently designed timber framing machines have rapid adjustments that permit the framing of a great variety of cuts.

Drift sets of any size and square sets of various sizes and with different framing can be cut without difficulty. Special machines are now being made for certain purposes, to frame cribbing for instance, which also have sufficient range of adjustment to cover any reasonable variation in size.

It appears that several of the timber merchants in the Northwest are equipped to frame timbers. Few of the larger users of timber however, buy it framed. The price quoted by manufacturers for framing is a little bit higher than the cost of the better equipped mines. A framing plant will cost from $5,000 to $25,000, according to the elaboration of the equipment.

The advantages which might be expected to result from framing at the source, cheapness of framing, saving of waste in cutting, and reduction in freight. The lumber merchant should be able to frame timber cheaper than the operators of small mines. There seems to be an opportunity to develop this field which will require only a moderate degree of standardization. Its backwardness is not due to lack of standardization, but from failure to develop the market.

Mine timbers are cut from the timbers remaining after orders for better qualities are filled. The waste in cutting can be reduced by the variety of short lengths required. Much of the timber bought by the large users in the Southwest is in random lengths at a saving of $1.00 to $2.00 per thousand in price. Timber on which no framing is to be done is sometimes bought in specified lengths to save extra handling and passing through the cut-off saw.

If the proper control of cutting is followed, there need be little waste in framing at the mine from random length timber. The short ends remaining after framing should not be more than is needed for blocks or wedges, for which there is a constant demand. There should be sufficient short blocks and waste material at the mills to provide cheap timber to supply blocks and wedges for all mines, but perhaps because of failure to work up the business properly, the price asked of the mines appears to be on the basis of the full price of the timber, plus freight and something for labor of cutting. The only actual waste, therefore, when framing at the mine is in what is too small to serve for either blocks or wedges. At one mine in the Southwest the waste is only one per cent of the timber put into the framing mill. In this case there are barely enough blocks and wedges to supply the mine. The waste in cutting, therefore, is not greatly reduced by framing at the source.

Freight rates, at least in the Southwest, are the same for framed as unframed timber, but there are references to higher rates for framed timbers in certain sections which it has been impossible to confirm.

If blocks or wedges can be made from the salvaged timber, freight will be saved by framing at the source. If they must

be bought outside and brought in, there will be no saving. In the mines of Idaho, Montana and Michigan and Colorado the supply of timber is usually from points near the mines. In Utah and the Southwest it is carried long distances by rail or steamer, or both, and freight is a very important part of the cost. It would be considerably reduced by seasoning before shipment. It has been suggested that rough finishing would reduce the freight without reducing the strength of the material. This, however, will raise the classification, and consequently the freight rates in most cases.

There is apt to be a certain amount of loss or breakage in the unloading and other handling of the mine of long lengths of timber, which would be avoided by framing at the source. If, however, it is to be shipped by vessel, the cost of rehandling short lengths would be somewhat greater.

The use of round timbers is very common in Idaho, Montana and Michigan, and of increasing importance in the Southwest. If of equal quality it is very satisfactory. Its use in chutes and similar construction is rather inconvenient, as there are no flat faces to work to. It is also awkward and bulky to handle in small cages or trucks. It should be cheaper than square timber since there is no cost of manufacture. In many cases it is of local origin and freights are less than on squared timber which is distributed from the Northwest for great distances. In the Southwest, at least, most of the round timber has a shorter life underground than timber from Washington and Oregon. Its use, therefore, is restricted to temporary work, stopes that are shortly to be abandoned, etc. There is some difficulty in getting and using the proper sizes of round timber, and in some cases it has been found that the consumption of round timber is a little greater for the same purpose than when square timbers are used. From the convenience in handling, its longer life, etc., square timber from the Northwest is preferred to round timber from local sources at an equal price. A large part of round timber is cut from tracts where there are no mills and can rarely be framed at the source. The Anaconda method of framing square sets is recommended for round timber as it will take any size of stick that may be used.

There may be an opportunity to develop a method of treating such timber to prolong its life, but it must be cheap.

Timber economy as a whole can be promoted by treatment by painting or dipping in a preservative or by more elaborate method of injection into the body of the timber. Covering timber with gunite has added to the life of timber in the Butte district. There are many methods of preservation under investigation, and no doubt something good will result. Many of them, however, are so costly that they cannot be used except for special purposes, as for shaft or station timbering. A method of timber preservation is not satisfactory if it increases the fire risk.

There are a few practical substitutes for timber. Steel has been used successfully for permanent work, but is very expensive and will not often be economically possible. Reinforced concrete sets have been used also and offer some encouragement for level work, but 6"x8" sections are as heavy as can be used without special methods of lifting. Heavier sections must be cast in place. It has been found that at times a light coat of gunite has eliminated the necessity of timbering.

Standardization may be expected to reduce costs by its application at individual mines and its moderate extension to all mines through national planning of mine structures both below ground and above. The standard of design would be raised, and by making chutes and other construction more or less similar their erection and use by miners who may be new to the district would be greatly facilitated.

By encouraging the framing of timbers at the source small mines would get their timbers framed cheaply without the cost to them of a framing mill. Beyond this no great benefit is apparent.

Logging and mill practice should be more thoroughly understood by mine operators. It appears certain that by thorough understanding of each others business methods by timber manufacturers and miners would result in mutual benefit.

I respectfully submit one or two recommendations for future action by the committee.

It will be advisable to have timber merchants represented on the committee, also a member who has had experience in timber treatment for preservation against decay.

As there is a great deal of ground to cover I suggest that each member of the committee be asked to cover some special subject, shaft sections, preservation of timber, substitutes for timber, etc.

The subject of timber preservation is of particular importance, and should be thoroughly treated.

Signed by GERALD SHERMAN, Chairman.

GENERAL RESUMÉ OF DATA OBTAINED FROM QUESTIONNAIRES SENT TO THE FOLLOWING SEVENTEEN MINING COMPANIES ON STANDARDIZATION OF MINE TIMBERS

(1) *Morenci Branch, Phelps Dodge Corporation.*
(2) *Copper Queen Branch, Phelps Dodge Corporation.*
(3) *United Eastern Mining Company.*
(4) *United Verde Extension Mining Co.*
(5) *United Verde Copper Co.*
(6) *Old Dominion Company.*
(7) *Calumet & Arizona Mining Co.*
(8) *Bunker Hill & Sullivan Mining Co.*
(9) *Inspiration Con. Copper Co.*
(10) *Magma Copper Company.*
(11) *Ray Consolidated Copper Co.*
(12) *Miami Copper Company.*
(13) *Nevada Consolidated Copper Co.*
(14) *Cleveland Cliffs Iron Co.*
(15) *Consolidated Arizona Smelting Co.*
(16) *Cananea Consolidated Copper Co.*
(17) *The Arizona Copper Co.*

Q. 1. From what section of country is your timber obtained?

ANSWERS:

Oregon, Washington and Texas are the chief producers of mining timbers. Northern Arizona, Northern California, Idaho and Northern Michigan produce small amounts of timbers which are consumed by nearby mines.

Q. 2. Transportation facilities and number of times handled before it reaches your mine?

ANSWERS:

For southwestern properties timber that is obtained from Oregon and Washington is taken to San Pedro by boat, thence by rail, generally, direct to the mines. In cases where local timber is used the most direct means of transportation is employed.

Q. 3. Kind of timber used, such as oak, spruce, cedar, pine, etc.?

ANSWERS:

Oregon pine (or Douglas fir) and Texas pine constitute the bulk of the timber used. Smaller amounts of Arizona pine, spruce, hemlock, Port Orford cedar, redwood, maple, birch, cedar and tamarack are also used.

Q. 4. How much is seasoned, and how much unseasoned timber?

ANSWERS:

There is not a very great difference in the relative amounts of seasoned and unseasoned timber used. No doubt in this respect the supply compared to the demand influences the amount of seasoning that can be done. Data follows: 6 companies used all seasoned timbers; 8 companies used all unseasoned timbers; 3 companies used part seasoned and part unseasoned timbers.

Q. 5. Total board feet used per year during each of the past five years?

ANSWERS:

Due to fluctuations in the past five years there is considerable variation in the yearly timber consumption shown by many of the mining companies. This fact necessarily makes our figures approximate, only. 114,500,000 board feet is roughly the total consumption per year of all companies supplying data.

Q. 6. What percent of above timber is sawed, and what percent round?

ANSWERS:

No. of Co.	% of Total Framed	% of Total Round	% of Total Split
1	80%	20%	
2	75%	25%	
3	100%		
4	100%		
5	97%	3%	
6	90%	10%	
7	80%	10%	10%
8		100%	
9	100%		
10	100%		
11	97%	3%	
12	64%	36%	
13	100%		
14		100%	
15	90%	10%	
16	78%	18%	4%
17	65%	35%	
Average	77%	22%	1%

Q. 7. What percent of total timber comes in standard lengths?

ANSWERS:

The list below showing the practice of each company in regard to buying timber in standard lengths is given for what it may be worth. It is doubtful whether this data can be used, inasmuch as there seemed to be, in the answers to the questionnaires, a difference of opinion as to the meaning of "standard lengths." In some cases it was taken as referring to standard lengths as regularly supplied to the trade by the lumber dealers. In other cases it was assumed that timber of lengths standard at the mine in question was meant.

No. of Co.	Percent
1	Random
2	30%
3	In multiples of 2'—100%
4	90%
5	Practically 100%
6	100%
7	100%
8	Random
9	
10	100%—Multiples of 2'
11	22% (mine lengths)
12	100%
13	100%
14	100%
15	100%
16	23% (Probably mine standard)
17	100%—Multiples of 2'

Q. 8. What percent of total timber is used in stoping, drifting, raising and sinking (winzes and shafts)?

ANSWERS:

No. of Co.	Stoping	Drifting	Raising	Sinking	Repairs	Miscellaneous
1	83%	4%	5%	1%	7%	
2	58%	8%	25%	2%	3%	4%
3						
4	78%	21%		1%		
5	90.7%	9.3% (dev.)				
6	75%	17% (dev.)			8%	
7	82%	5%	13%			
8	90%	5%	1.5%	3.5%		
9	45%	35%	20%			
10						
11	10%	89.5%	0.5%			
12	59%	19%	7%			
13	4%	7%	76%	13%		
14	55%	25%	20%			
15						
16	60%	27%	12%	1%		
17	82%	7%	11%			

Q. 9. What are the various sizes of timber used in stoping operations?

ANSWERS:

Size of Timber	No. of Co. Using	Size of Timber	No. of Co. Using
2" Boards	13	6x8	3
8x8	11	10x12	3
10x10	11	6x6	2
8" Round	8	6x10	2
3" Boards	7	Split Lagging	2
4" Boards	6	Poles	2
10 to 12" Round	5	12x12	1
8x10	4	10"-14" Round	1
5x8	4		

Q. 10. What are the various sizes of timber used in drifting operations?

ANSWERS:

Size of Timber	No. of Co. Using	Size of Timber	No. of Co. Using
8x8	11	8x12	2
10x10	11	8" to 10" Round	2
2" Plank	10	8x10	2
12x12	8	10x12	2
4" Plank	6	Split Lagging	2
3" Plank	4	6x10	1
6x8	4	6x12	1
Round Stulls	4	18" Round	1
12x14	3	Poles	1
10" to 12" Round	2		

Q. 11. What sizes of timber are used underground with no framing whatever, and what proportion of the total do they constitute?

ANSWERS:

Various sizes.

No. of Co.	Per Cent.	No. of Co.	Per Cent.
1	60%	4	20%
2	31%	5	61%
3	80%	6	35%

No. of Co.	Per Cent.	No. of Co.	Per Cent.
7	15%	13	None
8	1%	14	3%
9	None	15	...
10	None	16	14%
11	52%	17	38%
12	5%		

Average, 28%

Q. 12. What sizes of timber must be sawed once, with the cross-cut saw, before being used underground, and what proportion of the total do they constitute?

ANSWERS:

Various sizes.

No. of Co.	Proportion	No. of Co.	Proportion
1	50%	10	....
2	17%	11	52%
3	60%	12	95%
4	7%	13	34%
5	17%	14	3%
6	100%	15	50%
7	None	16	85%
8	1%	17	43%
9	60%		

Average, 42%

Q. 13. What sizes of timber must be framed, either by hand or by a framing machine, before being used underground, and the proportion of the total?

ANSWERS:

Various sizes.

No. of Co.	Proportion	No. of Co.	Proportion
1	40%	10	....
2	52%	11	48%
3	20%	12	1%
4	60%	13	66%
5	39%	14	97%
6	70%	15	30%
7	70%	16	....
8	100%	17	19%
9	40%		

Average, 47%

Q. 14. Is there any timber framed at its source and shipped to you framed? If so, what sizes and what proportion of the total?

ANSWERS:

Thirteen out of the seventeen companies have no timber whatever framed at the source; one has all of its timber framed at the source, and three companies a small percentage. In this connection it is of interest that the freight rates from San Pedro to Clifton, Arizona, on framed and unframed timber are as follows:

	Per Ton	Per M.
Unframed	$ 8.10	$13.91
Framed	16.30	27.97

Q. 15. What does it cost you to frame your timber at the plant per 1,000 board feet?

ANSWERS:

No. of Co.	Cost per M.	No. of Co.	Cost per M.
1	$ 3.00	10	10.00
2	3.00	11	2.21
3	....	12	1.50
4	1.15	13	3.00
5	....	14	9.00
6	2.25	15	....
7	3.25	16	2.95
8	....	17	3.00
9	2.00		

Approximate average, $3.50

Q. 16. Is any of your stoping timber interchangeable with that used in your drifting or raising work?

ANSWERS:

Thirteen companies answered "yes." Four companies answered "no."

Q. 17. Have you at present definite or proposed plans for reducing the number of different sizes of timber used either in stoping or drifting? If so, will you indicate roughly the proposed nature of these changes?

ANSWERS:

Fourteen companies answered "no." One company answered "yes."

Q. 18. What timber framing machinery do you employ?

ANSWERS:

Name of Machine	No. of Co.	Name of Machine	No. of Co.
Cut-Off Saw	9	Dapper	3
Single End Framer	8	Cribbing Splitter	1
Rip Saw	6	Car Loader	1
Double End Framer	5	Wedge Bundler	1
Wedge Cutter	4	Dado	1
None	4		

Q. 19. What kinds of lagging do you use?

ANSWERS:

No. of Co.	Mining Method	Character of Lagging.
1.	Shrinkage, top-slicing, some sq. setting	2x12 split.
2.	Mostly sq. setting, some top-slicing, cut and fill (incline)	5′ split, 2″x10″ and 12″x5′ sawed lagging.
3.	Horizontal cut and fill	2x12. Merch. O. P
4.	Sq. setting and Mitchell stoping	Oregon and Native Arizona, sawed lagging in 2″ and 3″ widths and lengths of 4′ 8″ and 5′ 4″.
5.	Horizontal cut and fill, sq. setting, shrinkage, glory-holing	5′4″ and 7′ 2″ Native Pine.
6.	Sq. setting, horizontal top-slicing, cut and fill	Oregon Pine, 2″ lagging only.
7.	Mostly incline cut and fill, sq. setting, Mitchell stoping	2x12″, 3x12″ and 4x12″ lagging, 2x6″—5′ long, split lagging.

8. Mostly sq. setting.....	2" plank lagging, random widths, 4'11" long, of which at least 50% is Douglas Fir and the remainder Tamarack, White Fir, Hemlock and Pine. When lumber supply is good, straight Douglas Fir is used, otherwise mixed lumber as above. These planks run from as narrow as 8 inches up to 20 inches in width and are cut by the mills from stock to the best advantage without waste by cutting in random widths.

No. of Co.	Mining Method	Character of Lagging.
9.	Incline raise system.....	Sawed—4'10" by 2"x10" and 2"x12".
10.	Sq. setting, top-slicing.....	Native Pine and Oregon Pine.
11.	All shrinkage	2"x6" Native—Side lagging for sq. sets and slicing. 2"x8"—Side lagging. 3"x10"—Top lagging for haulage drifts. 6"x6"—Top lagging for drawing sections. 6"x8"—Top lagging for drawing sections. 4"x6"—Spiling. 4" 2x8"—Spiling.
12.	Shrinkage system	2" and 3" sawed plank
13.	Incline raise system.....	2"x12"—Lagging. 2"x6" —Lagging.
14.	Mostly top-slicing	Cedar, Jack Pine, Spruce and Tamarack, split and round. Round lagging is not less than 2¼" diameter, and split is not more than 150 pieces to the cord. For covering down floors we use 9' and 10' poles, cross-lagged with 5' or 7' lagging, mostly 7', or we use 1" maple boards 6" wide or wider, 6' long or longer. These also serve as sollars for shoveling. It takes about 1' of board per ton of ore mined, where boards are used. With lagging at 1 cent a foot and boards at $40.00 per M., the two methods are about equal in cost.
15.	Cut and fill, shrinkage, sq. setting	4"x12". Both Native and Oregon Pine. 3"x12". 2"x12". Split round timbers—6"x8" tops.
16.	Top-slicing, cut and fill, sq. setting, shrinkage	California and Texas split, and Texas slab stock sawed lagging used.
17.	Top-slicing, shrinkage, cut and fill	Split lagging, 5'. 3" round, 10'. 2x12, 5'.

DISCUSSION BY GENERAL CHAIRMAN CHAS. A. MITKE OF INFORMATION OBTAINED FROM QUESTIONNAIRES SENT TO SEVENTEEN LARGE MINING COMPANIES ON STANDARDIZATION OF MINE TIMBERS

Replies to Questions 1, 2 and 3 need not be commented on.

Question 4. How much is seasoned and how much unseasoned timber?

Comment. It is evident that at least eight companies purchase all unseasoned timber. However, it may be stated in safety that these particular companies purchase such large quantities of timber at one time that a large percentage of it becomes seasoned before it is used.

It is a well-known fact that seasoned timber does not decay as readily as unseasoned timber, and wherever possible seasoned timber should be used in all drift and raise work.

In lining up the final recommendation of the Timber Committee it might be well to include among the findings a recommendation to the effect that "seasoned timber should be used in all drift and raise work."

Question 6. What percentage of total board feet of timber used during the year is sawed, and what per cent round?

Comment. The replies to this question show a notable increase in the amount of round timber used. Only six to ten years ago, practically all timber used was square, and while at present some companies are using as low as 3 per cent round timber, others are using as high as 100 per cent. This, undoubtedly, is a notable saving for those companies who use a large amount of round timber. A detailed examination of the questionnaires show that Companies Nos. 8 and 14 use 100 per cent round timber; that Company No. 12 has increased its purchases of round timber from 15 per cent in 1915 to 36 per cent in 1919; that Company No. 16 has also increased the amount of round timber used in its mines from 6.33 per cent in 1916 to 18.25 per cent in 1919; that Company No. 2 now uses 25 per cent round timber in its mines, whereas not long ago the amount was practically zero; that Company No. 11 and Company No. 6 are contemplating experiments with the use of round timber instead of square, and that Company No. 17 uses 35 per cent round timber in its mines.

It would be interesting, in this respect, to hear from Company No. 8 and Company No. 14, as to why they prefer the use of all round timber, and if their use of all round timber is just as satisfactory as if they were using all sawed square timber. A similar inquiry addressed to Company No. 12, Company No. 16 and Company No. 2, inquiring as to the basic reasons which impelled them to increase their purchases of round timber, should be productive of much interesting information. Inquiries addressed to Nos. 6, 11 and 17 in this same respect should also prove helpful.

It would also be interesting to hear from Company No. 5, as to what has been the determining factor which has caused them to reduce their percentage of round timber from 34 per cent in 1916 to 3 per cent in 1920, also why they have announced their intention to discontinue the use of round timber altogether; also to hear from Companies Nos. 3, 9 and 10, as to why they prefer square to round timbers.

Question 8. What per cent of total timber is used in stoping, drifting, raising, and sinking (shafts and winzes)?

Comment. Apparently by far the larger proportion of all timber used goes into stoping and is usually not recoverable under any circumstances. Drift timber is recoverable at times, but it is generally impossible to salvage any of the timber used for repairs, raising and winzing.

Question 9. What are the various sizes of timber used in stoping operations?

Comment. The resumé shows the various kinds of timber but omits the exact sizes of timber for the various mining methods. For example, the following information would lead to concrete results:

Exact dimensions of all timbers used in square set stoping in each particular mine.

Exact dimensions of timbers used in all top-slice stopes in each particular mine (horizontal and incline).

Exact dimensions of timbers used in all cut and fill stopes in each particular mine (horizontal and incline).

The above would not, of course apply to the caving systems; however, the following information might be obtained from these:

Exact dimensions of timbers used in pony sets.
Exact dimensions of timbers used in chute sets.

The following information might be obtained from all companies:

Exact dimensions of timbers used in raise sets.
Exact dimensions of timbers used in drift sets.
Exact dimensions of timbers used in tunnel sets.

Were this information segregated, and tabulated under the various stoping methods used, it would then be very much more suggestive. For instance, under square sets, the number of companies using this method might be given, with the various sizes of square sets employed. The same would refer to cut and fill (incline and horizontal); top-slicing (incline and horizontal) and the caving methods. This investigation would reveal, in the first place, that all companies using the square set method have different dimensions for the length, width and height of their square set timbers. Some of the companies having the heaviest ground use the largest size square sets, while companies with medium or light weight ground use the medium or small size square set, which is only intended really for very heavy ground.

If the above information were available and put before the committee, it might then be found possible for the committee to arrive at some recommendations for two or three standard size square sets for the light, medium and heavy ground. A similar investigation would reveal floors being taken out by top-slicing, from 7 feet to 11 feet in height. The investigation may show the practicability of recommending certain length and sizes of posts, kind of lagging, sizes of chutes, etc., which are suitable and have been found by experience to be the most advantageous for all incline top-slicing. This investigation would also show the possibilities of the application of standardization to horizontal top-slicing, incline and horizontal cut and fill, and to the caving methods.

Question 10. What are the various sizes of timber used in drifting operations?

Comment. The comments and suggestions made under Question 9 would apply equally to Question 10.

Instead of the multiplicity of drift and tunnel sets now in use, it may be possible for the committee to select from all the various dimensioned drifts three or four standard types of drift sets, ranging from the small prospect drift to the large size motor tunnel.

Questions 11, 12, 13, 14, 15 and 16.

Comments. The tables and information given in reply to the above questions are most interesting and well worth further consideration.

Question 17. Have you at present definite or proposed plans for reducing the number of different sizes of timber used either in stoping or drifting? If so, will you indicate roughly the proposed nature of these changes?

Comment. An investigation regarding the further standardization of mine timbers will automatically stimulate interest in this subject, and therefore the replies to this question cannot be accepted as conclusive. Nearly all companies at the present time are either working at plans for standardizing their timber still further, in order to effect greater economies, or they are working on present standards in order to change these to better satisfy local conditions. A close observer, making constant visits, can always notice a slow but perceptible change taking place as regards timber standards, which leads one to believe that progress has not by any means stopped in the standardization of timber.

In looking over the individual answers to No. 17, I note that Companies Nos. 6 and 11 are planning some experimental work by substituting round for square timbers. Incidentally, although not mentioned in the questionnaire, Company No. 4 has been doing some experimental work with the use of concrete sets in places where the life of the timber is very short. Company No. 7 has been doing a great deal of experimental work with different kinds of drift sets. I believe the summary of replies to this question would be more suggestive had it been arranged in the following manner:

Eight companies answered "no," the others replied as follows:

No. of Co.	Reply
1.	Owing to the indefiniteness of our plans we have at present no definite scheme for reducing the number of different sizes of timber used.
5.	We have reduced the number of sizes by 30 per cent in the past three years. Do not believe we can make further reduction in this number, as we have only two types of drift timber (drift and gangway), one size of lagging, one size of bulkhead timbers, and a single and double cribbing.
6.	No proposed plans except the use of split lagging instead of sawed, and round timbers instead of square.
9.	We have standardized drift sets, pony sets, chute sets, and square sets in raises.

11. Speaking generally, we have in view the substitution of smaller timber in a few cases where experience seems to warrant so doing. We also plan to experiment with substitution of round posts for square posts in exploratory drifts, with 5″ round lagging instead of 6″x6″ lagging in drawing sections, and with slab lagging instead of 2x8 side lagging.

13. There are no plans at present time for reducing the sizes used in drifting or stoping.

14. We have standardized on 8′ sets and 5′4″ cribbing, so that there will be no waste in a 16′ log. All framing has been adapted to standard log lengths. All round timber used.

16. No changes contemplated at present.

17. Not worked out sufficiently to know what we will do.

Question 18. What timber framing machinery do you employ?

Comment. The replies to this question are interesting but need not be commented on.

Question 19. What kinds of lagging do you use?

Comment. It appears there is a great variety of lagging used. Some companies use lagging only 2″ in thickness, while others go to the great expense of using lagging 6″ thick. Some prefer it sawed, while a great many prefer split lagging, etc. A great many caves occur in square set stoping, and it is believed that this is entirely due to the use of unsuitable lagging, which breaks and allows the caves to start.

MINE TIMBER PRESERVATION

R. R. HORNOR* and GEO. M. HUNT**

Of the enormous volume of timber used each year by the mines of the United States a considerable percentage is used above ground or in permanent haulageways and other places which are to be kept open for a number of years. When such timber decays rapidly, as it very commonly does, and must be renewed every two, three or four years, the result is high timbering costs, interference with mine operation, increased danger of accidents, high fire hazards, and rapid depletion of the timber supply adjacent to the mine. Many mines which formerly were able to obtain durable timber cheaply are now forced to take what they can get and are faced with the necessity of very soon drawing their timber from distant sources with consequent high costs.

The expense of timbering is not so likely to be noticed during periods of great prosperity when the demand is chiefly for pro-

*Mining Engineer, U. S. Bureau of Mines, Washington, D. C.
**In Charge, Section of Wood Preservation, U. S. Forest Products Laboratory, Madison, Wis.

duction, but in times like the present, when business is slack and mines operating part time or not at all, it becomes very noticeable. When it is necessary to keep a considerable number of men busy renewing timber, while not a pound of ore or coal is being produced, the leak becomes noticeable.

In deep mines, where the problems of the ventilating engineer multiply, large quantities of decaying timber add to his difficulties by vitiating the air and increasing the temperature. Warm and vitiated air lowers the efficiency of the workmen and reduces their output. The magnitude of this element in mine ventilation is not fully realized, and it cannot be fully realized until more study has been given to it, but that it is of real importance can hardly be denied.

Perhaps the greatest menace with which the mine operator has to contend in mines where large quantities of timber are used is the fire hazard. A number of disastrous fires in recent years have resulted in great loss of property and in some cases loss of life. Decaying and punky timber, especially where the bark has not been removed, is a greater fire menace than sound peeled timber. Therefore any steps which will prevent mine timber from decaying will lessen the fire hazard.

The useful life obtained from mine timbers varies widely, depending on the species of timber used, its quality, the care given it while in storage, and the conditions in the mine. Some mines may be able to get high grade, durable timber which will last five to ten years, but with a great many of them two or three years is the average. Where the air is dry timber will last longer than where it is damp. Timbers with a large percentage of heartwood will last longer than sap timber. Timber which has started to decay while in storage will rot much quicker than timber which has received proper care.

Perhaps the simplest way in which the life of mine timber can be increased is by peeling. Bark retards seasoning and tends to keep the timber damp. It also harbors insects which weaken the timber by their activities and open passageways which favor the rapid progress of decay. It has been demonstrated in actual tests in a mine that peeled timber was appreciably more durable than similar timber with the bark on.

The surest way to increase the life of timber to the maximum is by the use of wood preservatives. The preservative treatment of wood has been practiced in this country and in Europe for nearly 100 years. During this time many materials have been used and many methods tried, and out of this wealth of experience a few preservatives and methods have come to be con-

sidered as standards, while the majority have fallen by the wayside.

Of all the preservatives which have been used in this country, coal tar creosote and zinc chloride are most generally accepted and most widely used. Both of these preservatives have demonstrated their effectiveness by innumerable tests, and today there are literally millions of pieces of timber in use which have been treated with one or the other of them.

The most effective way to apply wood preservatives is by means of pressure. This permits better penetration of the preservative and thus better protection to the wood than is likely to be obtained by any other process. Pressure treating equipment is relatively expensive and only those mines which have large quantities of timber to treat can afford it. Pressure treated mine ties and timbers may be purchased from commercial treating companies in some localities. If it is practicable by any means for a mine to secure pressure treated timber, this is strongly recommended.

Where pressure treatment is impractical, simpler and less expensive treatments are available. The best non-pressure treatment is the hot and cold bath open tank process which is carried out by immersing the timber first in a bath of hot preservative for one or more hours, and then in a bath of cool preservative for the same or a longer time. With the right kind of timber, peeled and properly seasoned, preservatives can be made to penetrate very satisfactorily by this simple process, and very effective protection can be obtained.

No one can be expected to go to the trouble of using preservatives unless he can be shown that it pays. This is easy to do. The Forest Service has been conducting experiments for many years in various mines, and it has been clearly demonstrated that at a relatively low cost the life of the timbers can be greatly increased. In one mine where untreated timber lasts about two years treated timbers have been in service for fourteen years and many of them are still sound. This treatment added but 10 or 15 per cent to the cost of the timber in place, but increased its life by 600 per cent. In other mines, where the untreated timber does not decay quite so rapidly, the savings have still been very great. Well treated mine timbers can reasonably be expected to resist decay from twelve to twenty years.

To summarize briefly, preservative treatment of mine timbers increases durability, saves labor and expense in timber maintenance, reduces delays and loss due to timber repairs and renewals, reduces fire hazard and danger of accidents, and makes the timber supply last longer. Preservatives and processes suitable for every mine are available and their use is strongly recommended.

REPORT OF COMMITTEE ON METAL MINE ACCOUNTING

The organization of this Committee was not completed until July, 1921, about which time the work was gotten under way.

The Committee in entering upon its work recognizes that the object of its labor is to formulate a system of accounts that, if followed, would show the true operating profit and costs and the actual condition of the business at the end of each period. Also, it realizes that any standard of accounts and costs that may be recommended should meet the demands of the Treasury Department governing the determination of income for the purpose of Federal Taxes wherever it is possible to do so without depreciating the value of the accounting and cost data to the operating organization.

The work of the committee has been partially completed, and therefore, at this time, we can make only a progress report.

In making a general survey of the subject, the committee decided that it would be necessary to group the metal mines producing ores and metals of a radically different character and to meet the requirements of each group. Therefore, the metal mines were divided into the following groups.

1. Base Non-ferrous Mines,
2. Ferrous Mines,
3. Precious Metal Mines, and
4. Rare Metal Mines.

The working out of a Standard Accounting and Cost System for Base Non-ferrous Mines has been partly finished. It is hoped to finish this in the future and to take up the requirements of the other groups. It is believed that the only changes that will be necessary for the other groups will be in the detail accounts, and that at least a standard Profit and Loss Statement and Balance Sheet will be obtained for all metal mines.

To facilitate the work of the committee, the subject has been divided into seven sections, as follows:

1. Disbursements, Asset and Expense Accounts.
2. Production and Production Revenue Accounts.
3. Capital and Capital Revenue Accounts.
4. Depreciation, Obsolescence, Depletion and Losses.
5. Profit and Loss, Dividends and Surplus.
6. Balance Sheet.
7. Costs.

Each section is being taken up separately and decisions made to meet the requirements of the Base Non-ferrous Metal Mines. Accounts, properly named, and Costs, that will meet the require-

ments of the metal mines as well as the demands of the Treasury Department, are being worked out upon a unit basis so as to allow of sufficient expansion if desired in the detail accounts and costs to accommodate the needs of each unit of the industry.

It is probably not necessary to mention the benefits that would accrue from the results furnished by a complete, up-to-date and uniform system of accounts and costs for metal mines, especially at this time when most of the metal mines are being operated either at a loss or on a small margin of profit, and every item of expense is closely analyzed and every means of reducing costs is being tried.

The managers and executives of metal mines are well aware that to properly manage the business, there must be complete and correct records, properly and uniformly compiled, showing the results of operations for each period in such manner as to meet the demands of the Federal and State Laws and of employees, as well as the needs of the business.

Since the enactment of the present Federal Tax Laws requiring complete and uniform accounting and cost data, efforts have been made by most of the metal mines to complete and standardize their accounts and costs, as far as the needs of each individual business demanded. However, as the accounting and cost systems of a large number of metal mines originated during the development stage, or at a time when large profits were being obtained, and when the keeping of complete records were considered more or less unnecessary, the initial accounting system was not always established upon the correct basis. As the business grew and the need became apparent for more accounting and cost data, as a rule, the accounting system was not revised and rebuilt on correct principles, but instead, additions or modifications were introduced to obtain the additional data with the least disturbance of the original methods.

As a result, the Managers of some of the metal mines are burdened with an accounting and cost system that is incomplete or out of harmony with the operations, or is expensive to operate and slow to give results to the operating staff. Therefore, in some instances the accounting and cost methods in use are as much out of date and as inefficient as would be a mill or smelter if operated with the equipment and methods in vogue, say, ten or fifteen years ago.

In other words, accounting methods, accounts and costs have not, as a whole kept pace with the development in organization, equipment and operating methods, the efforts being made "to put new wine in old bottles."

While most of the large metal mines have developed complete systems of accounts and costs, the data obtained, in many instances, is compiled in such a manner as to be of no value to anyone not familiar with the system used. An operating head upon leaving the employ of one mine and entering the organization of another mine may find that he must familiarize himself with operating statements of costs, etc., compiled upon a different basis and in a different manner.

The lack of uniformity, disregard for correct principles and the forcing of new data through old channels and into antiquated forms has resulted in a certain amount of apathy in the minds of the operating department heads for accounting and cost data to the detriment of the business. Also there has resulted in the workmen suspicion as to the motives and veracity of the managers and owners of mine properties, and exaggerated ideas as to the profits of mines, especially in the minds of those composing the taxing bodies.

The Cost Sheet in the hands of the operating man is his compass and if it be defective it is not probable that the port of the greatest possible profit will be reached.

It is the desire of the Committee to work out the following fundamentals: First, a Standard of Asset, Expense and Revenue Accounts that will provide for the proper charges and credits to Capital and to Operating Expense and Revenue, etc., and allow of the determination of production costs in a uniform manner by all metal mines; second, a Standard Profit and Loss Account, or Income Statement, that will clearly show the net profits for each period of operation in a uniform manner for each and every unit of the industry; third, a Standard Form of Balance Sheet, uniformly grouped and arranged so that the condition of the business can be quickly and accurately ascertained and compared with every other unit of the industry; fourth, a certain method of procedure in the determining of Operating Costs for each unit of the metal mining industry so that an operating head of any department of one metal mine may compare his costs with the costs obtained in a like department by other mines and know that the costs were obtained in a like manner.

As in Production the object is to keep the product moving forward in as direct a line as practicable with the least expenditure of money and time, so in Accounting the object is to keep the operating and business data from each department moving in as direct a line as possible to the Accounting and Cost Departments and there to be assembled into the proper form to be

of the greatest value and to pass on to the manager and executives, and to return in part to the head of each department, with the least expenditure of time and money. The value of the Accounting and Costs to each individual unit depends upon three things: First, the correctness of the original data; second, the proper assembling of the data, and, third, the time in which the assembled results are delivered to the operating heads. The value of the assembled data of one unit to other units of the industry, to the government, to the stockholders, and to the general public depends upon uniformity.

The Committee is desirous of obtaining complete lists of Accounts used by the different metal mines together with forms of Profit and Loss Account and Balance Sheets and methods of determining Operating and Production Costs. Such data have been received already from a number of the metal mines, but contributions by other mines would be appreciated. Also, the committee is open for suggestions that anyone may wish to make to obtain the proper compiling and presenting the Accounts and Costs in a uniform manner.

Signed by T. O. McGRATH, Chairman.

(Following is a brief discussion of the Progress Report of the Committee on Metal Mine Accounting, October 18, 1921, Acting General Chairman William B. Daly presiding:)

MR. McGRATH: I wish to say that the work of this committee, the same as a great number of others, is only in a state of progress, our committee not having been completely organized until July of this year.

Our hope is to at least place a profit and loss statement before you for each mine, and show you what all mines in which you are interested are doing in net results, taking the balance sheet the same way, and seeing what condition in each mine compares with similar conditions in your mine, etc. We know we can do that. We also hope to get a system of costs, so if you are working in one mine you can know that your costs when obtained were obtained in the same way they were in another mine.

In the Tax Section, this afternoon, there was brought out the great difficulty of the government with tax matters, and it was stated that one of the great difficulties was the lack of uniformity and the lack of data. The 1917 and 1918 statements have not all been checked, and that is one of the great drawbacks. They can't get at the facts. One of the reasons is because the mines have not had uniform costs, and each mine has its own system of keeping its own record. Very few mines kept complete records prior to the tax laws. They figured that as a kind of unnecessary evil; therefore, they had no more of it than was necessary. But now you must keep those records complete, whether you want to or not. The more uniform they are, the better it will be for you and the greater benefit it will be to your other units operating around you, as well as a help to the government.

For instance, in Bisbee three different systems of accounts are kept by three different mines. Every once in a while they get together and

try to compare their drifting costs, their stoping costs, etc., and they vary quite a bit; they commence analyzing and find out one company figured track men and pipe men in total number of employees by which footage was divided, another figured repairs on stopes and counted these men in, while a third company did not, and so on. Their costs, therefore, are absolutely useless for comparative purposes. The consequent result is they show practically no interest in one another's costs.

I think you will realize that this doesn't produce very good results. We had a case regarding the construction of a new power plant. Our general manager asked the master mechanic why he couldn't obtain better costs with his power plant, at least equal to those of another company that had well kept costs. He replied: "Well, if we kept our costs like they do we would have the same costs." That is the way they generally settle the argument of costs. It is all due to lack of uniformity.

CHAIRMAN DALY: I think I can add to Mr. McGrath's statement that the same thing prevails in practically every mining district in the country: every mining company figures different items in its cost sheets, and they are therefore of no avail at all for comparative purposes. Uniformity in costs, I think, is of the utmost importance from the viewpoint of standardization.

PROGRESS REPORT OF COMMITTEE ON UNDERGROUND TRANSPORTATION

A questionnaire, as hereinafter fully set forth, was mailed to every member of this committee, with a request that the questions contained therein be answered and forwarded to the chairman for compilation.

This questionnaire, to date, has been answered by ten companies, as follows:

Bunker Hill & Sullivan Mining & S. Co.; Compania Real del Monte; Moctezuma Copper Company, Cananea Consolidated Copper Co.; Anaconda Copper Company; The Arizona Copper Company; Copper Queen Branch, Phelps Dodge Corporation; Miami Copper Company; Calumet & Arizona Copper Company; Inspiration Con. Copper Co.

The following pages contain the original questions, together with a compilation of the replies received.

QUESTIONNAIRE

Q. 1. What are the various forms of haulage employed in your mine?

ANSWERS:

Company
No.

1. (a) Hand Tramming. (b) Motor Haulage. (electric trolley), (c) Motor Haulage (storage battery).
2. Hand tramming and storage battery locomotives.

3. (a) Hand tramming, (b) electric haulage (trolley type), (c) electric haulage (storage battery type).
4. The Cananea Consolidated Copper Company, S. A., uses hand tramming, mule haulage and motor haulage (electric, trolley type) in their mines.
5. 20 mines use hand haulage, 13 mines use mule haulage, 16 mines use trolley type motor haulage and 7 mines use storage battery type motor haulage.
6. Hand tramming, mule and electric haulage.
7. Motor, mule and hand.
8. Electric trolley, storage battery motor—very small tonnage.
9. Hand tramming, mule haulage and motor haulage (electric).
10. Compressed air locomotives for ore; electric trolley for waste.

Q. 2. What percentage of all ore and waste is handled by each form?

ANSWERS:

1. Hand tramming, ore, 9.7 per cent; waste, 4.1 per cent. Storage battery, ore, 90.3 per cent; waste, 58.4 per cent. Trolley motor, ore, .0 per cent; waste, 37.5 per cent. The ore handled out of Kellogg tunnel adit is 100 per cent trolley motor.
2. Hand tramming, 66 per cent; storage battery locomotives, 34 per cent.
3. Daily output hand trammed, 81 per cent; daily output motor trammed (trolley), 87 per cent.
   Overlapping of percentage due to the fact ore and waste are often handled twice. Note: Storage battery locomotive installed this year; doing excellent work; will gradually replace trolley haulage.
4. The percentage of material handled by each of the above systems is approximately as follows: Electric motor, 40 per cent; hand tramming, 55 per cent, and mule tramming, 5 per cent.
5. Hand tramming, 11 per cent; mule tramming, 17 per cent; trolley motor, 56 per cent; storage battery, 16 per cent.
6. Hand tramming (transfers to chutes only), 90 per cent; mule tramming (transfers to chutes only), 10 per cent. The main haulage is 100 per cent trolley type motor.
7. Hand tramming, 30 per cent; mule tramming, 10 per cent; trolley type motor, 80 per cent.
   The overlapping in percentages is caused by handling some ore twice.
8. All ore down raises to main haulage level is trammed by hand, where electric haulage, trolley type, removes it. Storage battery tramming, too small to consider.
9. Hand tramming, 5 per cent; mule tramming, 30 per cent; motor haulage, 65 per cent.
10. Compressed air locomotives, 100 per cent ore; trolley, 100 per cent waste.

Q. 3. What different types of hand tramming cars do you use?

ANSWERS:

1. There are three styles of hand tramming cars, side dump, and dump and scoop cars.

2. See photostat of dwg. H-2-457.* (This drawing is attached to his report, which is also attached to this report and made a part thereof.)
3. Side dump. See Blue Print marked C; Watt end dump, see Blue Print marked D; end dump with swivel converted into side dump. (These drawings are attached to his report, which is also attached to this report and made a part hereof.)
4. All hand tramming cars are of the revolving end-dump style.
5. 29 mines use Anaconda No. 1 and No. 2 cars; 1 mine uses Davis-Daly special, similar to Anaconda No. 2. (The drawings for these cars may be obtained by writing to Mr. Norris.)
6. End-dump, revolving and gable-bottom, side-dump.
7. V—Rocker side-dump, square swivel side or end-dump, square side-dump.
8. Box—end-dump.
9. Only one type, revolving end-dump—iron box.
10. No hand tramming.

Q. 4. How many of each kind?

ANSWERS:

1. There are five scoop cars, 10 side-dump and 6 end-dump.
2. 66 with 20 cu. ft. body; 188 with 24 cu. ft. body.
3. (a) 2 side-dump (this car is to replace the end-dump); (b) 144 Watt end-dump; (c) 4 converted side-dump.
4. There are about 600 in use.
5. 6,337 Anaconda No. 2 cars are in use for hand hauling; 350 Anaconda No. 1 cars are in use for hand hauling; 158 Davis Daly special cars in use for hand hauling.
6. 275 end-dump, revolving; 20 gable bottom, side dump.
7. 500 Sw. dump, 300 V. R. dump, 200 side-dump.
8. 70 box end-dump.
9. 625 revolving end-dump—iron box.
10. No hand tramming.

Q. 5. Give cubic feet capacity of each kind.

ANSWERS:

1. 5 scoop cars, capacity 12 cu. ft.; 10 cars side-dump, capacity 20 cu. ft.; 5 cars end-dump, capacity 30 cu. ft.; 1 car end-dump, capacity 20 cu. ft.
2. 20 cu. ft. and 24 cu. ft.
3. All hand tram cars 22 cu ft.
4. Their measured capacity is 16 cu. ft.
5. Anaconda No. 1 cars have 16 cu. ft. capacity; Anaconda No. 2 cars have 14 cu. ft. capacity; Davis Daly special cars have 14 cu. ft. capacity.
6. 275 End-dump, revolving; 20 gable bottom, side dump. 40 cu. ft. capacity.
7. Sw. dump 12 cu. ft., V. R. D. 15 cu ft., side-dump 15 cu. ft.
8. 20 cu. ft = 1 ton; 30 cu ft. = 1½ tons; Box end-dump.
9. 16 cu. ft.
10. No hand tramming.

*This and other illustrations mentioned in this report were not furnished by this committee.

Q. 6. Which of the above cars are roller bearing?

ANSWERS:

1. The scoop cars, five of the 20-ft. side-dump cars, and one 20-ft. end-dump car are babbitt bearing; five 30-ft. end-dump and five 20-ft. side-dump are roller bearing.
2. All.
3. All.
4. About 20 per cent are Anaconda type axles, and the balance are roller bearing.
5. 2,872 roller bearing cars are in use.
6. All.
7. All. Hyatt.
8. All.
9. None.
10. None.

Q. 7. If guards are provided for hands and fingers of trammers when pushing cars describe them.

ANSWERS:

1. A bar is provided at the rear of the car near the top that can be grasped by the hands, which eliminates the danger of crushing the hands between the drift and the car.
2. None provided.
3. None provided.
4. No special hand guards are provided.
5. None of these cars are provided with guards.
6. None provided.
7. None provided.
8. (Not answered.)
9. None provided.
10. None.

Q. 8. What gauge of track is used for above cars?

ANSWERS:

1. 24-inch gauge is used.
2. 19¾ inches (50 cmts.).
3. 20-inch gauge.
4. Gauge of track for above cars is 18 inches.
5. 3 mines use 20-inch gauge track, 22 mines use 18-inch gauge track.
6. 20-inch gauge.
7. 20 inches.
8. 18 inches.
9. 18-inch gauge.
10. None.

Q. 9. What weight of rail?

ANSWERS:

1. A 16-lb. rail is used.

2. 16 lbs. per yard.
3. 16-lb. rails.
4. Standard rail is 16 lbs.
5. 18 mines use 12-lb. rails, 6 mines use 16-lb. rails, 1 mine uses 25-lb. rails.
6. Weight of rails, 16 lbs.
7. 16 lbs.
8. 16 lbs.
9. 12-lb. rail,
10. None for hand tramming.

Q. 10. What is size and spacing of ties? (That is, how far apart are ties laid?)

ANSWERS:

1. The ties are 4"x6"x4' and are spaced as needed, usually about one foot.
2. 4"x5"x40", spaced 24", ties are heavy and long enough to carry 25-lb. rail when latter is laid for motor haulage.
3. 4"x4" ties, 24" spacing.
4. Ties are 4"x6" and spaces 18" apart.
5. 16 mines use 3"x10"x30" ties, 6 mines use 4"x10"x30" ties, 2 mines use 4"x10" runners, 1 mine uses 5"x7"x48" ties, 2 mines use 20" spacing, 13 mines use 30" spacing, 3 mines use 36" spacing, 4 mines use 42" spacing, 1 mine uses 5'4" spacing.
6. Size and spacing of ties, 3"x6" and 4"x6", spaced 30" centers.
7. 4"x4"x3', 15" spacing.
8. 4"x8"x2'6", spaced 18" to 24".
9. 4"x4"x30" or 4"x6"x30", spaced 3 feet apart.
10. About 15" space.

Q. 11. What per cent grade is standard for all hand tramming drifts?

ANSWERS:

1. The standard grade for all hand tramming drifts is one-half of one per cent in favor of the trammer.
2. .75 per cent
3. .5 per cent maximum grade.
4. For hand tramming tracks are given a grade of 8 inches to the hundred feet, or 0.65 per cent.
5. 1 mine has 0.41 per cent grade, 15 mines have 0.43 per cent grade, 3 mines have 0.50 per cent grade, 4 mines have 0.62 per cent grade, 1 mine has 0.83 per cent grade, 1 mine has 0.66 per cent grade.
6. 0.4 per cent in favor of load where practical, otherwise level.
7. 0.5 per cent.
8. Level.
9. ½ of 1 per cent.
10. No hand tramming.

Q. 12. Give dimensions of hand tramming drifts in the clear.

ANSWERS:

1. Drifts are 5'x7'.
2. 7' high by 7' wide.
3. 5'x7'.

4. Drifts intended for hand tramming are 7′ high and 6′ wide.
5. 18 mines have dimensions of 4′6″x7′3″ in the clear; 2 mines have dimensions of 5′x7′ in the clear; 1 mine has dimensions of 6′x8′ in the clear; 1 mine uses battered sets 3′6″x7′x5′ in the clear; 1 mine uses battered sets 4′x5′x7′ in the clear; 1 mine uses battered sets 4′x6′x6′6″ in the clear; 1 mine uses battered sets 4′6″x7′x7′6″ in the clear.
6. Dimensions of hand tramming drifts, 4′6″x6′6″ in the clear.
7. 5′x8′.
8. See small blue print, ¾″x1′. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. 5′x7′.

Q. 13. What are the sizes and types of loading chutes?

ANSWERS:

1. The chutes are 3′x3′9″, built of heavy plank, with a slope of 30 degrees.
2. For shrink stopes see photostat of sketch; for cut and fill stopes same style of chute is used, but single instead of three close together, spaced 25 ft. to 30 ft. (This photostat is attached to his report, which is also attached to this report, and made a part thereof.)
3. Stope chutes are 9 post, including manway; drift chutes are 2 post. (See blue prints A and B attached. These blue prints are attached to his report, which is also attached to this report, and made a part thereof.)
4. Loading chutes for hand tramming are generally the ordinary square set chute 3 feet in width at the mouth and closed by two gate boards.
5. 2 mines use 22″x24″ size chutes; 5 mines use 24″x24″ size chutes; 1 mine uses 24″x20″ size chutes; 2 mines use 24″x30″ size chutes; 1 mine uses 26″x20″ size chutes; 1 mine uses 26″x16″ size chutes; 1 mine uses 26″x24″ size chutes; 1 mine uses 28″x20″ size chutes; 3 mines use 27″x20″ size chutes; 1 mine uses 30″x20″ size chutes; 1 mine uses 30″x22″ size chutes; 3 mines use 30″x30″ size chutes; 1 mine uses 33″x24″ size chutes; 1 mine uses 36″x18″ size chutes; 1 mine uses 36″x20″ size chutes.
6. (Blue print attached.) (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
7. 4′2″x4′5″, 6 post; 4′4″ square; 2 coup crib.
8. 2′-10″ inside. (See blue print.) (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. Practically only one size and type of loading chute is used. Print A-2-C 524 gives details. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
10. Chutes approx. 3′x3′, built of 3″ plank.

Q. 14. Give clearance between cars and chutes.

ANSWERS:

1. The clearance between cars and chutes is 6 inches.
2. Never less than 6 inches.
3. 13-inch clearance.
4. The standard clearance between chute mouth and small mine cars is 6 inches.

5. 3 mines have a clearance of 4 inches between cars and chutes; 7 mines have a clearance of 6 inches between cars and chutes; 6 mines have a clearance of 8 inches between cars and chutes; 2 mines have a clearance of 10 inches between cars and chutes; 3 mines have a clearance of 12 inches between cars and chutes; 2 mines have a clearance of 13½ inches between cars and chutes; 1 mine has a clearance of 15 inches between cars and chutes; 1 mine has a clearance of 18 inches between cars and chutes;
6. Blue print attached. 2-J-520. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
7. 6 inches.
8. See small blue print. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. Clearance from 6 inches to 8 inches.
10. Clearance from 6 inches to 12 inches.

Q. 15. Describe type, or types, of chute doors which are standard in your mines for all hand tramming drifts.

ANSWERS:

1. There are three plank gates which are staggered vertically.
2. See sketch. (This sketch is attached to his report, which is also attached to this report, and made a part thereof.)
3. The plain 2x12 board door has been found most economical. (See blue prints marked A and B attached. (These blue prints are attached to his report, which is also attached to this report, and made a part thereof.)
4. Answered in No. 13.
5. 5 mines use iron doors, operated by lever; 3 mines use iron stoppers; 16 mines use wooden stop boards; 1 mine uses iron and wood stop boards.
6. Blue print attached. A-J-520. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
7. Iron arc hand level control and wooden gravity doors. See Bulletin No. 6, Volume 3. (This bulletin is attached to his report, which is also attached to this report, and made a part thereof.)
8. Stopper board. See blue print. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. Chute doors in hand tramming drifts are wooden plank, as shown in print A-2C-254. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)

MOTOR HAULAGE (Electric—Trolley Type)

Q. 16. If electric haulage, with trolley type is the principal form, give number of electric motors, weight of each, and make.

ANSWERS:

1. There are 11 trolley locomotives, as follows: (a) General Electric, 8,000 lbs., 1,000 lbs. draw bar pull; (b) General Electric, 9,000 lbs., 1,200 lbs. draw bar pull; (c) General Electric, 10,000 lbs., 1,200 lbs. draw bar pull; (d) Bunker Hill and Sullivan, 10,500 lbs., 1,200 lbs. draw bar pull; (e) General Electric, 13,700 lbs., 2,800 lbs. draw bar pull; (f) Jeffrey Co., 11,656 lbs., 2,400 lbs. draw bar pull; (g) Jeffrey Co., 5,000 lbs.; (h) General Electric, 14,000 lbs.; 3,000 lbs. draw bar

pull; (i) General Electric, 16,280 lbs., 3,200 lbs. draw bar pull; (j) General Electric, 16,400 lbs., 4,000 lbs. draw bar pull; (k) General Electric, 14,000 lbs., 3,000 lbs. draw bar pull.

2. No trolley type locomotives are used underground; two installations are used to haul ore to mill through tunnels from surface.
3. 400 level 3 Goodman locomotives, 6,000 lbs.; 600 level 1 Westinghouse, 8,000 lbs.; 800 level 1 Westinghouse, 8,000 lbs.; 1,000 level 2 Westinghouse, 8,000 lbs.; 700 level 4 General Electric, 20,000 lbs.; surface 1 Westinghouse, 9,000 lbs.; surface 1 Baldwin, 8,000 lbs.
4. The electric locomotives in use here at present are: 5 4-ton Jeffrey; 2 4½-ton Baldwin-Westinghouse, and 3 10-ton Jeffrey; 10 in all.
5. 17 mines have a total of 143 electric locomotives. 3 mines have 17 Jeffreys, weight 3½ tons; 17 mines have 102 Westinghouse-Baldwin, weight 3½ tons; 8 mines have 24 General Electric, weight 3½ tons.
6. 23 6-ton units, type D. M., class 30, Jeffrey locomotives; direct current, 250 volts.
   These are combined in sets of 2 or 3 units, as service requires.
7. 18 2-7½ tons, 6 6-tons, 2-7½ tons, Westinghouse motor; others Goodman.
8. 10 6-ton Goodman, single motor locomotive, type M. 5-60.
9. 10 electric locomotives, Westinghouse, skeleton frame, 3½ tons, single end, double motor.
   These motors have proved to be very satisfactory.
10. 3 Westinghouse trolley locomotives (2-2½ tons and 1-2 tons).

Q. 17. Give height of trolley wire from rail, and voltage of wire.

ANSWERS:

1. The trolley is 6 feet 5¾ inches from the rail and has a voltage of 500 volts.
2. No trolley type locomotives are used underground.
3. 8 feet, voltage 250.
4. The standard height for trolley wire is 7 feet above the rail, and 260 volts are carried.
5. 16 mines have a height from rail to trolley wire 6 feet 9 inches, voltage 250; 1 mine has a height from rail to trolley wire 9 feet, voltage 250.
6. Height of trolley wire from rail 7 feet 6 inches; voltage of wire 250 D.C.
7. 7 feet, 250 volts.
8. 7 feet 10 inches, 220 volts.
9. Height of trolley wire from rail 7 feet 3 inches; voltage, 250 volts.
10. Wire is 7 feet no inches above rail and voltage is 440 D.C.

Q. 18. Is any provision made for protection from electric wires at loading chutes, and, in general, throughout the mine? Outline the various measures used.

ANSWERS:

1. At the main loading chute the trolley is about 8 feet above the rail, which puts it out of reach of the workmen. At other chutes an inverted wooden trough is placed over the wire to guard against contact with it.
2. No trolley type locomotives are used underground.
3. Opposite loading chutes trolley wires are elevated to between 10 and 11 feet above rail. In some cases a 2x12 frame is erected between trolley and chute.

4. At chutes, protection to loaders is given by the usual 1x6 board shields on both sides of the wire.
5. All trolley wires are enclosed on three sides by wooden boxes.
6. Protection from electric wires at loading chutes and elsewhere: (a) Trolley wires carried under loading chute platforms. (b) Lights at loading chutes. (c) Sectional insulators and switches at convenient point, to cut off current for protection of repairmen.

   For details see accompanying blue print 3-M-17. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
7. Cutout used in line with By Pass. Wire raised to 8 feet 6 inches over chute.
8. See large blue print of standard chute and drift set showing boxing as guard. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. Wire is protected throughout the mine by two timber guards of 1 inch by 6 inch material, spaced 6 inches apart—one on each side of wire. Top of guard is at height of wire. Some years ago the trolley wire at chutes was covered by a swinging door hinged to the trolley guard, at time of loading for same. At the present time the trolley wire is entirely removed from in front of the chute set while loading and the exposed ends covered by swinging board. This is accomplished by using a section of ¼-inch rod and also a section of ½-inch pipe as trolley wire. The pipe is electrically connected to the trolley wire. When a chute is to be loaded, the rod slides into the ½-inch pipe by sliding back a movable section of trolley guard, which is fastened to one end of the rod. As the trolley guard and rod clears the sides of the adjoining caps, a swinging board about 1 inch by 8 inches by 12 inches covers the end of the exposed wire. When this cut-out is open the current is carried past the gap by an insulated wire at the side of the drift. The above scheme has proved to be very satisfactory. It is very easy to operate and permits considerable more head room above the cars at the chutes.
10. No trolley wire at loading chutes.

Q. 19. How many different types of haulage cars are used? What are they?

ANSWERS:

1. There are three types of the haulage car for electric trolley locomotives, each weighing 2,472 lbs., bottom dump with a hopper bottom. (a) The ordinary babbitt bearing car. (b) The roller bearing car with springs. (c) The roller bearing car without springs.
2. No trolley type locomotives are used underground.
3. (a) "Hoya" or round bottom car, side-dump, with trunnion at each end. (b) Automatic side-dump waste cars. (c) 30-ton cars on 700 level.
4. Three different types of haulage cars are used here, a 2-ton capacity saddle-back car, a 4-ton capacity saddle-back car, and a 6-ton capacity hopper bottom car.
5. 1 mine uses No. 1 Anaconda cars, 1 mine uses No. 1 and No .2 Anaconda cars, 15 mines use No. 2 Anaconda cars.
6. Gable bottom, side dumping.
7. One. Rocker side-dump.
8. Gable bottom, side-dump.
9. Only one type of car, a saddle-back, holding about 3 tons of sulphide, is used. See print A-2-C-408. (This print is attached to

his report, which is also attached to this report, and made a part thereof.)

10. Only one type.

Q. 20. How many of each kind?

ANSWERS:

1. (a) 38 babbitt bearing cars; (b) 39 roller bearing cars with springs; (c) 6 roller bearing cars without springs.
2. No trolley type locomotives are used underground.
3. (a) 80 Hoyas; (b) 11 5-ton waste cars; (c) 45 30-ton cars.
4. There are about 60 of the 2-ton cars, 40 of the 4-ton type, and 30 of the 6-ton type.
5. 4,445 No. 2 Anaconda cars are in use; 684 No. 1 Anaconda cars are in use.
6. (a) 40 10-ton cars, equipped with automatic air brakes, journal bearings and M.C.B. couplings; (b) 99 5½-ton cars; (c) 9 4½-ton cars; (d) 41 3½-ton cars.
7. 800.
8. 200.
9. 128 cars.
10. No answer.

Q. 21. Give cubic feet capacity of each kind.

ANSWERS:

1. All cars have a capacity of 46.4 cubic feet.
2. No trolley type locomotives are used underground.
3. (a) Hoyas, 33 cubic feet; (b) side-dump waste cars, 90 cubic feet; (c) 30-ton cars, 600 cubic feet.
4. The 2-ton saddle-back car has a measured capacity of about 35 cubic feet; the 4-ton saddle-back car about 65 cubic feet, and the 6-ton hopper bottom car about 110 cubic feet.
5. Anaconda No. 2 cars have 14 cubic feet capacity; Anaconda No. 1 cars have 16 cubic feet capacity.
6. (a) 10 tons, 200 cubic feet; (b) 5½ tons, 108 cubic feet; (c) 4½ tons, 90 cubic feet; (d) 3½ tons, 70 cubic feet.
7. 33 cubic feet, 19 cubic feet, 15 cubic feet.
8. 66⅔ cubic feet.
9. 38 cubic feet.
10. Not answered.

Q. 22. How many cars and tons are pulled by the average train?

ANSWERS:

1. The average train has 17 cars, with a load of 50 to 55 tons.
2. No trolley-type locomotives are used underground.
3. (a) Goodman, 5 cars, 7½ tons.
   (b) Westinghouse, 10 cars, 15 tons.
4. The usual train is made up of 10 or 12 cars. The different sized cars are used at different mines under different conditions of service and are handled by locomotives to match.
5. 7 mines pull 10 cars, 7.0 tons; 1 mine pulls 9 cars, 7.2 tons; 1 mine pulls 10 cars, 8.0 tons; 2 mines pull 12 cars, 8.4 tons; 1 mine pulls 12 cars, 10.0 tons; 4 mines pull 15 cars, 10.5 tons; 1 mine pulls 18 cars, 10.8 tons.

6. (a) 30 10-ton cars, 300 tons (underground haulage); (b) other sizes, from 6 to 20 cars per train, depending upon requirements; used for short haul transfers, developments, etc.
7. 15 to 60 tons.
8. 20 to 30 cars, or 66⅔ and 100 tons.
9. On long hauls over straight track, with only few curves, 16 cars (50 tons) constitute a train. On short hauls (up to 2,000 ft.), over considerable number of curves, 10 cars constitute a train. The motors will handle more, but maximum efficiency is reached in hauling train as outlined above.
10. Not answered.

Q. 23. How long has this form of haulage been in use?

ANSWERS:

1. This form of haulage has been in use since 1903.
2. No trolley-type locomotives are used underground.
3. About 12 years.
4. This form of haulage has been in use here for the past 10 or 12 years.
5. This form of haulage has been in use for 14 years.
6. (a) With smaller cars, about 15 years; (b) with 10-ton cars, about 7 years.
7. 13 years.
8. 10 years.
9. Since 1914.
10. 6 years.

Q. 24. Motor Haulage (Storage Battery Locomotives). Are storage battery locomotives used for main haulage, or only for gathering motors to make up trips for large motors on main lines?

ANSWERS:

1. Storage battery motors are used only as gathering motors to bring ore from stopes to shaft pockets.
2. For main haulage in two of the large mines; small tonnage mines are hand tramming only.
3. Will be used below 1,000 level for both main haulage and gathering.
4. There are no storage battery locomotives in these mines.
5. 7 mines use storage battery locomotives for main haulage.
6. None.
7. Not answered.
8. For very light work, mainly on development on haulage level where electric wire has not been strung. Tonnage too small to consider.
9. Not answered.
10. None.

Q. 25. If storage battery locomotives are used, give number of locomotives, weight and make of each.

ANSWERS:

1. The Bunker Hill & Sullivan has six storage battery motors, as follows: (a) Jeffrey Co. 2½-ton, (b) Westinghouse-Baldwin 3½-ton, (c) General Electric 4-ton, (d) Westinghouse-Baldwin 4½-ton, (e) General Electric 2½-ton, (f) Jeffrey Co. 4½-ton.
2. 11 in use at present, more being installed. General Electric, 5-ton, type L. S. B., class 2-C-5.

3. Jeffrey, 8,000 lbs. (on 1,200 level).
4. (Not answered.)
5. 7 mines have a total of 41 storage battery locomotives; 2 mines have 2 Baldwin-Westinghouse, weight 5½ tons; 5 mines have 19 General Electric, weight 5½ tons; 1 mine has 9 Jeffreys, weight 4 tons; 1 mine has 11 Westinghouse-Baldwin, weight 4¼ tons.
6. None.
7. (Not answered.)
8. 1 4-ton storage battery motor, Jeffrey Mfg. Co., No. 3753, type BEM, class 20; Edison cell battery, type 86.-.87.
9. (Not answered.)
10. None.

Q. 26. .How long can storage battery locomotives operate without recharging?

ANSWERS:

1. Storage battery locomotives can be used for about 8 hours without recharging. Use two sets of batteries for each motor. One is being charged while other is in use.
2. 7 to 8 hours.
3. 8 hours.
4. (Not answered.)
5. Can operate 8 hours without recharging.
6. None.
7. (Not answered.)
8. About 12 hours. Booster charge generally given while idle.
9. (Not answered.)
10. None.

Q. 27. How many different types of haulage cars are used with this type of locomotive? What are they?

ANSWERS:

1. There is one type of car used. It is a bottom dump with a hopper bottom, similar to the car on the main electric trolley haulage, except that it is smaller. These cars are both roller and babbitt bearing.
2. One, see photostat of dwg. H-397. (This photostat is attached to his report, which is also attached to this report, and made a part thereof.)
3. (a) Side dump 22 cu. ft., same as hand tramming. Equipped with hooks and chain; (b) Hoyas; (c) some hand tram end dump cars are being used temporarily.
4. (Not answered.)
5. No. 1 and No. 2 Anaconda cars are used with this locomotive.
6. None.
7. (Not answered.)
8. Gable bottom, side dump; 3⅓ tons..
9. (Not answered.)
10. None.

Q. 28. How many of each kind?

ANSWERS:

1. There are 68 cars with roller bearings and 6 cars with babbitt bearing.

2. 90 cars in use.
3. (a) 2 side dump; (b) 80 Hoyas; (c) 30 end dump.
4. (Not answered.)
5. 2,397 No. 2 Anaconda cars; 350 No. 1 Anaconda cars.
6. None.
7. (Not answered.)
8. Train variable, depending on work. 4 to 6 cars.
9. (Not answered.)
10. None.

Q. 29. Give cubic feet capacity of each kind.

ANSWERS:

1. These cars have a capacity of 34 cu. ft.
2. 51 cu. ft.
3. (a) 22 cu. ft. side dump, (b) 33 cu. ft. Hoyas, (c) 22 cu. ft. end dump.
4. (Not answered.)
5. Anaconda No. 2 cars have 14-cu. ft. capacity, Anaconda No. 1 cars have 16-cu. ft. capacity.
6. None.
7. (Not answered.)
8. 66⅔ cu. ft.
9. (Not answered.)
10. None.

Q. 30. How many cars and tons are pulled by the average train?

ANSWERS:

1. The average train has 8 cars with a load of about 17 tons.
2. 7 cars, 16.1 metric tons of ore plus 1.2 tons weight of each car—16.1 plus 1.2x7=24.5 metric tons=54,000 lbs.
3. 12 cars, 12 tons.
4. (Not answered.)
5. 1 mine pulls 8 cars, 5.6 tons; 3 mines pull 10 cars, 7.0 tons; 1 mine pulls 12 cars, 7.5 tons; 1 mine pulls 12 cars, 10.0 tons; 1 mine pulls 15 cars, 10.5 tons.
6. None.
7. (Not answered.)
8. 4 to 6 cars.
9. (Not answered.)
10. None.

Q. 31. How long has this form of haulage been in use?

ANSWERS:

1. Storage battery motor haulage has been in use since March 3, 1913.
2. About 15 months.
3. Two months.
4. (Not answered.)
5. This form of haulage has been in use 8 years.
6. None.
7. (Not answered.)
8. 4 to 5 years.

9. (Not answered.)
10. None.

Q. 32. Give reasons why the use of storage battery locomotives is advantageous in your mines.

ANSWERS:

1. Storage battery motors can advance into drifts and tunnels as fast as rails can be laid. They obviate the necessity of bonding the rails and installing the trolley, and the added expense of removing the trolley should the drift be abandoned. It can assist itself if derailed. Since it carries a voltage of only 8-100 volts, the maintenance of the controller system is much reduced. The absence of the 500 volts trolley wire eliminates danger of contact due to low drifts and chutes projecting into the drift. In repairs, timbering and in changes of timbering or general layout the trolley wire and accessories must be moved and changed at great expense and annoyance, and constitutes an ever-present danger to all workingmen, but especially to the uninformed and careless.
2. Eliminates danger from trolley wire in front of chutes and can reach isolated parts of mine, such as drifts, cross-cuts and small stopes where installation of trolley would not pay.
3. Can be used on development and production for haulage and gathering. Can operate in smaller, hence cheaper, drives. Very heavy trolley installation and upkeep expense is eliminated.
4. (Not answered.)
5. Safety and cost of upkeep.
6. None.
7. (Not answered.)
8. None, except to help out prior to main trolley work.
9. (Not answered.)
10. None.

Q. 33. How does the cost of haulage by storage battery locomotives compare with the electric trolley system?

ANSWERS:

1. Storage battery motor is about 30 per cent higher than trolley haulage.
2. Have no means of comparison.
3. Has not been installed long enough to give figures.
4. None.
5. (Not answered.)
6. None.
7. (Not answered.)
8. Really no comparison as it is a negligible quantity.
9. (Not answered.)
10. None.

MOTOR HAULAGE (Compressed Air Locomotive)

Q. 34. If the Compressed Air System is used, give number and weight of Locomotives, also makes.

ANSWERS:

1. Not used in Bunker Hill & Sullivan mine.
2. Has no installation.

3. No compressed air locomotives at this mine.
4. There are no compressed air locomotives used here.
5. (Not answered.)
6. None.
7. (Not answered.)
8. Not used.
9. (Not answered.)
10. Fourteen 10 ton, 2 Stage Porter air locomotives, carrying 800 lbs. pressure throttled down to 200 pounds for high pressure cylinder.

Q. 35. How long can motors be used without recharging?

ANSWERS:

1. (Not answered.)
2. Have no installation.
3. Have no installation.
4. Have no installation.
5. (Not answered.)
6. None.
7. (Not answered.)
8. (Not answered.)
9. (Not answered.)
10. One locomotive hauls twenty loaded 5 ton cars (100 tons) down .4% grade 3000 feet and push empties back on one charge of air.

Q. 36. How many different types of haulage cars are used with this type of locomotive? What are they?

ANSWER:

No. 10 only. 20 five ton cars.

Q. 37. How many of each kind?

ANSWER:

No. 10 only. 350 cars.

Q. 38. Give cubic foot capacity of each kind.

ANSWER:

No. 10 only. 106 cubic foot capacity.

Q. 39. How many cars and tons are pulled by the average train?

ANSWER:

No. 10 only. 20 cars to a train.

Q. 40. How long has this system of haulage been in use?

ANSWERS:

1. Not used in Bunker Hill & Sullivan mine.
2. Have no installation.
3. No compressed air locomotives at this mine.
4. There are no compressed air locomotives used here.
5. (Not answered.)
6. None.
7. (Not answered.)

8. Not used.
9. (Not answered.)
10. Six years.

IN GENERAL

Q. 41. Give gauge of track, weight of rail, size and spacing of times for all motor drifts.

ANSWERS:

1. The electric trolley haulage track is of 24" gauge with 50 lb. rails and is furnished with 6"x8"x4' ties spaced as needed. The storage battery motor tracks are of 24" gauge with 30 lb. rails and are furnished with 4"x6"x3' ties, spaced as needed, but usually about one ft.
2. 19¾" (50 cmts.) 25 lb. rail 4"x5"x40", spaced 24 in.
3. All levels except 700-20" gauge—16 and 25 lb. rails, 4"x6" ties 18" apart.
4. The track over which we handle the 6-ton cars is laid with 50 lb. rails; the gauge of this track is 38" and the ties are 8"x8" and laid 20 in. apart. In all other motor drifts the rails are 35 lb., gauge of track is 18 in. and ties are 6x8 and spaced 24" apart.
5. 18 mines have 18" gauge track for all motor drifts and 25 lb. rails; 3 mines have 20" gauge track for all motor drifts and 25 lb. rails; 1 mine uses 3"x6"x30" ties; 2 mines use 3"x8"x30" ties; 6 mines use 3"x10"x30" ties; 5 mines use 4"x10"x30" ties; 1 mine uses 5"x7"x34" ties; 3 mines use 5"x10"x30" ties; 1 mine uses 6"x10"x30" ties; 2 mines use runners 4"x10"; 1 mine spaces ties 18"; 2 mines space ties 20"; 1 mine spaces ties 2'; 7 mines space ties 20"; 2 mines space ties 32"; 4 mines space ties 36"; 1 mine spaces ties 48"; 1 mine spaces ties 60"; 2 mines space ties 42".
6. Gauge of track 20"; weight of rails 48 lbs. for heavy haulage; 25 lbs. to 35 lbs. for light haulage; size of ties 6"x8", 4' long; spacing of ties 20" to 24", center to center.
7. 20" gauge; 25 and 40 pound; 4"x6"x3'6" ties, 15" centers, also 5x8 3'5" ties.
8. 24"; 30 lbs. now 45 lbs.; 4"x8"x3'6"; 18".
9. Gauge 18 inch; 25 lb. rail; ties 4x6"-36" long, spaced 24" apart; at switches larger ties are used.
10. Gauge 30", rails 40 lbs., ties 6"x8" spaced every 2 feet.

Q. 42. What per cent grade is standard for haulage drifts?

ANSWERS:

1. One half of one per cent grade in favor of the motor is the standard for all motor drifts.
2. 0.75%.
3. Not to exceed .5%.
4. The standard grade for all motor tracks is 6 in. to the hundred feet, or 0.50%.
5. 1 mine has 0.32% grade; 11 mines have 0.43% grade; 3 mines have 0.50% grade; 1 mine has 0.52% grade; 3 mines have 0.62% grade; 1 mine has 0.66% grade; 1 mine has 0.83% grade.
6. 0.4% in favor of the load.
7. 0.5%.
8. 0.5%.
9. Standard 0.5%. Some drifts are run on .25%.
10. .4% in favor of loads.

Q. 43. Give dimensions of all haulage drifts in the clear.

ANSWERS:

1. The electric trolley haulage tunnel is 8′ wide by 7′ high, in the clear. The storage battery drifts are 5′ wide by 7′ high, in the clear.
2. 7′ high by 7′ wide.
3. 5½′x8½′.
4. Haulage drifts for 38″ track are 8′ wide and 9′ high; and for 18″ track they are 7′ wide and 8′ high.
5. 15 mines have haulage drifts 4′6″x7′3″ in clear; 1 mine has haulage drifts 5′0″x7′3″ in clear; 1 mine has haulage drifts 5′0″x7′6″ in clear; 1 mine uses battered sets 4′x6′x7′; 1 mine uses battered sets 4′6″x7′6″x7′ in clear; 1 mine uses battered sets 4′x8′x7′7″; 1 mine has haulage drifts 9′0″x10′0″ in clear. (See text.)
6. Dimensions of haulage drifts, 8′x8′ in the clear.
7. 5½′x8½′.
8. See large B.P. (This blue print is attached to his report, which is also attached to this report and made a part thereof.)
9. Motor haulage-ways 5′x6½′. Motor drifts 5½′x8′.
10. Haulage drifts 7′6″ in clear from cap to base of rail.

Q. 44. What provision is made for drainage in all drifts?

ANSWERS:

1. A ditch is left at one side of the track for the water on the lower levels to run to the sump of the pump, where it is delivered to the main haulage tunnel and runs to the outside by means of a ditch next to the track.
2. Drain on one side of track.
3. Ditches.
4. There is so little water in these mines that shallow ditches, sometimes cemented, are sufficient.
5. 16 mines have ditch in center of drift.
   14 mines have ditch in side of drift.
6. Drainage of drifts,—concrete ditches where necessary.
7. Drainage ditch 6″x12″—side of drift where needed.
8. Ditch to one side.
9. In ground which might possibly be wet, ditches are carried at side of drift while same is advancing. In isolated wet spots water is piped through raises to lower wet levels.
10. A boxed gutter is carried on one side of drift.

Q. 45. Are there electric lights in all haulage ways? How far apart are lights distributed, and are there lights over all switches?

ANSWERS:

1. There are lights in all haulage ways. On the storage battery haulage ways they are distributed as needed, as on the main haulage way they are 50 ft. apart. All switches are provided with electric lights.
2. Only in main drifts, spaced 35 ft. to 40 ft.; yes.
3. No. There are lights at all dumps and at principal loading chutes, but not spaced in haulage ways. There are lights on some, but not all, switches.
4. There are electric lights in all haulage ways, with lights over all switches, at all chutes, and 100 ft. apart elsewhere.

5. 23 mines have electric lights in haulage drifts.
   9 mines have lights 100 ft. apart.
   5 mines have lights 50 ft. apart.
   1 mine has lights 15 ft. apart.
   2 mines have lights 75 ft. apart.
   4 mines have lights 60 ft. apart.
   1 mine has lights 150 ft. apart.
   21 mines have lights over switches.
6. Electric lights are placed at all switches and manway safety stations, and generally distributed about 100 ft. apart along the drifts.
7. Yes; 100 ft.; yes.
8. Yes; about 150 to 200 ft.
9. All haulage ways are electric lighted. Lights are placed over all switches. On Main line motor drifts lights are spaced about 100 ft. apart; on branch lines from 100 to 200 ft. apart; on curves lights are spaced at closer intervals.
10. Haulage drifts have electric lights spaced 100 feet apart and lights are also placed over switches.

Q. 46. Is a general signal system used? If so, give brief description.

ANSWERS:

1. A block system is used on the main haulage tunnel. Trains coming in are indicated by green and have the right of way until the motor man of that train throws the light off. Trains going out are indicated by red lights and have the right of way until the motorman of that train throws the lights off. Provision is made for the use of these block signals at four different places on the main haulage way.
2. No.
3. No.
4. It has not yet been necessary to install a general signal system, because the work here is spread over such a wide territory that it has been possible so far for each motor crew to operate independently.
5. 5 mines have block signal system.
6. Colored lights are attached to all switches to indicate the position of the switch; for train protection there is a block-signal semaphore system, operated by the trolley circuit, connected through the locomotive pantograph to a signal wire paralleling the trolley wire.
7. Yes; block system.
8. Red lights at switches on main line. Switch closed on entry, flares, red light. Open on way out cuts off light. Simple.
9. No general signal system used. On curves where travel is in both directions over a single track, a block signal consisting of a red light and Klaxon horn, operated by the flange of car wheel passing over a switch plate, announces the passing over a given point by a train, giving warning to other trains and persons using same section of drift. On branch lines a manually operated switch operates a light at the main track switch, which announces the presence of a motor on that track. In addition the general lighting system is used as a flash system over whole sections of track from certain central points.
10. Yes; block signal system, like that of most railroads.

Q. 47. Is any special ballast used for road beds in haulage drifts? If so, give brief description of same.

ANSWERS:

1. No special ballast.
2. No.
3. No.

4. No special ballast is used for road beds.
5. No special ballast is used for road beds.
6. No special ballast is used for road beds.
7. Slag and broken quartsite in drifts through aluminous formation.
8. No special ballast.
9. General ballast used is material cut in drifts.
10. Ballast is ordinary mine rock.

Q. 48. Which of the cars used for motor haulage are roller bearing?

ANSWERS:

1. Most of the cars are roller bearing.
2. All.
3. All.
4. Roller bearings are used on the 4-ton and 6-ton cars.
5. 2,772 cars are roller bearing.
6. None of the cars used for motor haulage have roller bearings; all motor haulage cars have journal bearing.
7. All.
8. All.
9. None.
10. No roller bearings used on ore cars.

Q. 49. Are brakes of any kind used on motor haulage cars? If so, describe them.

ANSWERS:

1. No brakes are provided on the cars, the train being controlled by the brakes on the motor.
2. Yes, see drawing H-397. (This drawing is attached to his report, which is also attached to this report, and made a part thereof.)
3. No, except on 30-ton R.R. cars, which use Westinghouse air brakes.
4. Brakes have not been found necessary on these grades.
5. No brakes used, but motor is kept at head of loaded train.
6. Some 5½-ton cars are equipped with hand brakes; 10-ton cars are equipped with automatic air brakes.
7. No.
8. No.
9. No.
10. No.

Q. 50. Give reasons why your present haulage system has been adopted for your conditions.

ANSWERS:

1. The main haulage way is two miles long and is, therefore, too great for compressed air locomotives, and they would not be efficient; gasoline locomotives would contaminate the air.
2. See answer 32.
3. We have always used trolley haulage on alternate levels and hand tramming between, but for reasons stated in No. 32, storage battery haulage will replace trolley on alternate levels below 700 level, which handles our full tonnage out of the mine, and which will continue to use trolley haulage.

4. With so many different mines, each with its peculiar transportation problems, it has been found necessary to use all three haulage systems and sometimes combinations thereof to meet local conditions economically.
5. (Not answered.)
6. The extent of the system required, the length of the haul, and the large tonnage to be moved, were considerations which led to the adoption of the electric trolley system. The 20" track gauge was adopted to conform with that already in use in the mines and laid upon the surface. The use of one gauge for hand and motor tramming, manifestly, is an advantage.
7. Wet aluminous ore requires special equipment for haulage and dumping. Hence the adoption of the Rocker dump cars. Swelling ground in haulage drifts makes heavy upkeep to tracks.
8. Easy to dump cars; train never broken when unloading; always in motion unloading; power; reasonable cost; motors and cars easily repaired.
9. Our haulage system was adopted to replace mule haulage at a period when the mine was fairly well developed. Ore bodies in the Warren District are rather small, irregular, and are scattered over a large area, necessitating a large amount of drifting and raising in comparison to the ore mined. Motor haulage is confined to the areas producing a large tonnage of ore, but is extended as new producing areas are brought in. At time motor system was adopted we possessed a full complement of 16 cubic feet cars, 18 inch gauge. For this reason we use the same gauge (18 inch) for motor and mule haulage. Small hand cars of waste are handled by the motors to some extent.
10. Air haulage was chosen rather than electric because it was thought to be safer and they are more convenient as gathering locomotives.

Q. 51. What are the sizes and types of loading chutes for motor haulage drifts?

ANSWERS:

1. All chutes have a 30-degree pitch. On the main haulage way they are 2 feet 6 inches wide by 3 feet high. On all other drifts they are 3 feet by 3 feet 9 inches.
2. See sketch and answer 13. For loading from bins or transfer chutes, where no big rocks can get through by grizzlies being used, an arc gate is used. See photostat of drawing F-2-336. (Sketch and photostat are attached to his report, which is also attached to this report, and made a part thereof.)
3. See blue prints attached, marked "E" for 700 level, and "A-B" for other levels. (These blue prints are attached to his report, which are also attached to this report, and made a part thereof.)
4. The loading chutes for motor haulage are usually built in the ordinary sill floor square set. The timbers are two sets high to permit building the chute at the proper height. The upper set provides a convenient place for the loader to work.
5. 2 mines have 22"x24" wooden chutes; 8 mines have 24"x24" wooden chutes; 1 mine has 24"x30" wooden chutes; 2 mines have 26"x24" wooden chutes; 1 mine has 26"x20" wooden chutes; 2 mines have 27"x20" wooden chutes; 1 mine has 30"x24" wooden chutes; 1 mine has 30"x30" wooden chutes; 1 mine has 32"x22" wooden chutes; 1 mine has 33"x24" wooden chutes; 1 mine has 36"x20" wooden chutes.

   Note: 22"x24" means chute mouth, 22" wide and 24" high.

6. See blue print attached (3-M-17). (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
7. Same as hand tram.
8. See arc gate on large blue print. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. See print A-2-A-224. (This print is attached to his report, which is also attached to this report and made a part thereof.)
10. Loading chutes are made of 2"x12" boards. Chutes 30 inches wide, and slope 40 degrees.

Q. 52. Give clearance between motor cars and chutes.

ANSWERS:

1. There is a clearance of 8 inches between the chute and the cars on the main tunnel and a clearance of 6 inches on all other drifts.
2. Never less than 6 inches.
3. 13 inches.
4. The standard clearance for motor chutes is 16 inches.
5. 2 mines have a clearance of 4".
   7 mines have a clearance of 6".
   6 mines have a clearance of 8".
   1 mine has a clearance of 10".
   2 mines have a clearance of 12".
   1 mine has a clearance of 13½".
   1 mine has a clearance of 15".
6. Clearance between motor cars and chutes, 16½ in.
7. 6 in. to 9 in.
8. See blue print. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. 8 in. clearance between lip of chute and car.
10. Clearance between motor and chute is nine inches, and between cars and chute is 16 inches.

Q. 53. Are end, or side dump, cars used in hand tramming? In motor tramming?

ANSWERS:

1. Both side-dump and end-dump cars are used in hand tramming. but only bottom dump cars in motor tramming.
2. See drawings. (These drawings are attached to his report, which is also attached to this report, and made a part thereof.)
3. Hand tramming, both end and side, are used, but a standard 22 cu. ft. side dump is being designed for both hand and motor haulage.
4. For hand tramming, end dump cars are used. Motor cars are either gable bottom side dumping, or hopper bottomed and center dumping.
5. All cars are end dump.
6. Answered in Par. 3 and 19.
7. Both—side dump.
8. End dump; side dump.
9. End dump in hand tramming; in motor tramming, side dump.
10. No hand tramming. Tiffle used for motor cars.

Q. 54. Describe type, or types, of chute doors, which are standard in your motor haulage drifts.

ANSWERS:

1. On the main haulage tunnel-chutes, the chute gate is a convex piece of sheet iron with the convex side toward the ore. This is provided with a long handle and is pivoted near the middle. By pushing down on the handle the gate is opened and vice versa. All other chutes have gates consisting of three individual planks staggered vertically.
2. See sketch. (This sketch is attached to his report, which is also attached to this report, and made a part thereof.)
3. See blue prints attached, marked "E" for 700 level, and "A" and "B" for other levels. (These blue prints are attached to his report, which is also attached to this report, and made a part thereof.)
4. The doors on motor chutes are iron arc gates, lever operated.
5. 6 mines have iron doors operated by lever; 1 mine has iron stop boards; 5 mines have iron and wood stop boards; 8 mines have wooden stop boards.
6. Arc chute doors, standard for all haulage chutes. For details see accompanying blue print No. 3-M-17. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
7. See Practical Mining Course, No. 6, Vol. 3. (This book is attached to his report, which is also attached to this report, and made a part thereof.)
8. Arc gates. See blue print. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. Most satisfactory chute door is an iron door having a removable pipe handle which operator opens from platform on opposite side of drift. Bottom of chute is provided with an apron to divert flow of ore to center of car. This apron is hinged so that it may be removed from drift after car is loaded. Print A-2-A-224 gives general details. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
10. Arc chute gates are used. They are made of steel plate, bent in an arc 24 inches long and radius of 24 inches. One end has a bar bent to be used as a handle.

SUGGESTIONS FOR STANDARDS

Q. 55. What would be your idea of a standard size and type of car for all hand tramming in your mine—handling the hard, sticky and fine material, both ore and waste?

ANSWERS:

1. A roller-bearing, box-shaped, end-dump, 20-foot car.
2. We have no very sticky ore, except in one small mine, and find our type of car quite suitable.
3. All stoping and development in this mine is done by contract, with a fixed price per ton for labor and explosives. This necessitates an accurate measure of ore. We find that we lose out with any section of car with the top larger than the bottom, as the car could appear full, but would be only heaped up in the middle with an empty space around the perimeter of the car. We, therefore, favor a car which gives us one full ton of ore or waste, and for this purpose the 22 cubic feet side-dump car has been adopted for both hand and motor haulage, except on the main Porvenir or 700-level tunnel, in which 30-ton cars are used for hauling the total production to the concentrator.

4. We have not been able to decide upon a standard car for all classes of ore. Our Rocker dump cars are too high for efficient mucking from drifts. Have found a 20 cubic feet car with a box 2x2½x4 feet, 40 inches in height, to be very satisfactory for hand tramming where ore is hoisted in cars.
5. The revolving end-dump car, equipped with roller bearings, and of about 16 cubic feet capacity, has been satisfactory for hand tramming.
6. Present type cannot be changed to advantage.
7. Our end-dump revolving cars of 20 cubic feet capacity are standard in our mines. We have practically no sticky ore. The overall dimensions of the box are 4 feet long by 2½ feet wide by 2 feet high. These cars should be roller bearing and have some kind of device for protecting the hands of the trammers, but to date we have not found anything suitable that the men themselves will always use.
8. Box, 20 cubic feet, end-dump, roller bearing.
9. Motors of our hand trammed cars are loaded by hand from the face of crosscuts. The material shoveled varies from limestone to pyrite. An ideal car must be able to hold the maximum amount of our lighter material (limestone), which can be trammed most efficiently and also be low enough not to impair the efficiency of the mucker when handling pyrite or sulphide ore. (Cars of sulphide are only loaded about three-quarters full.) Such a car is about a 15 cubic feet car, with the top about 42 inches above the rail, iron box revolving on trucks, end-dump, with door fitting tightly (for fine material). We have only a very small amount of sticky material and, hence, do not have to consider that in our tramming problem.
10. No answer.

Q. 56. What would be your suggestion regarding a standard car for all motor haulage (giving dimensions, height of car, tonnage capacity, etc.)?

ANSWERS:

1. A car 6 feet 6 inches long, 3 feet 4 inches wide and 4 feet 2 inches high, weighing about 2,500 lbs. and having a capacity of 46 cubic feet and a tonnage capacity of 3 tons. This car should be provided with springs and roller bearings. For assembly cars, it should carry at least 34½ cubic feet. The Bunker Hill car is 3 feet by 5 feet and 3 feet 6 inches high.
2. See drawing H-397. This car being same height and wheels same gauge as hand car, both motor haulage and hand tramming can be done from same chutes. (This drawing is attached to his report, which is also attached to this report, and made a part thereof.)
3. See 55 for dimensions; see blue prints No. A-B-52. (These blue prints are attached to his report, which is also attached to this report, and made a part thereof.)
4. It would be difficult to standardize satisfactorily. A 2-ton car is handy to shovel into and can be moved by the usual mucking crew in a drift; the 4 and 6-ton cars are preferable when handling ore from chutes.
5. A larger car would be of great advantage in ore handling, but would not fit with our drift and shaft conditions.
6. We are of the opinion that two standard sizes of motor cars should be used under our conditions, viz.: (a) For the bulk of our heavy hauling of ore to the hoisting shaft, 10-ton cars, shown in outline or blue print. (b) For development drifts and for transferring ore on upper levels of mines to motor chutes, 5½-ton cars. Both these cars are of the same general design and differ only in size.

7. For our conditions the 33 cubic feet Rocker dump car is very suitable, but I cannot recommend it except for special conditions.
8. This entirely depends on power cost, method of handling trammed ore, state laws with regard to trolley wires, and tonnage required.
9. A standard car for motor haulage will vary with the type of our deposit, tonnage mined and length of haul. Under the conditions in the Warren District, where the amortization on each mile of motor drift is high, the cars should be of a size so as to fit the most economical size of motor drift. As these cars are filled from motor chutes, the height is only limited by the clearance between top of the ore and the trolley wire, taking also into consideration the clearance of chutes. Another fact to be considered is cost of unloading ore at the pockets. A saddle-back car requires less labor and attention than probably any other car in unloading sticky ores or hard ores (with the exception of cars dumped by tipple). My idea of a standard motor car is a saddle-back, about 40 to 50 cubic feet capacity, after the general type of car shown in print A-2-C-408. (This print is attached to his report, which is also attached to this report, and made a part thereof.)
10. No answer.

Q. 57. What is your idea regarding a standard gauge of track, weight of rail, per cent of grade for drift, and dimensions of drift, for all hand tramming?

ANSWERS:

1. A 24-inch gauge track, with 30-lb. rails, and a grade of one-half of one per cent in favor of the trammer. The drift should be at least 5 by 7 feet.
2. Should be same as for hand tramming, except weight of rail.
3. Standard gauge, 20 inches; weight of rail, 16 lbs.; grade .5 per cent; drift, 5 by 7 feet.
4. For hand tramming, the drift should be 7 feet high and 6 feet wide. The track should be 16-lb. rail laid on a 0.65 per cent grade and to an 18-inch gauge.
5. 18-inch gauge, 12-lb. rail, 0.43 per cent grade. 4′6″x7′3″.
6. 20-inch gauge, 16-lb. rails, level grade and 5′x7′ drifts, generally untimbered.
7. 18-inch or 20-inch gauge, 12-lb. to 14-lb. or 16-lb. rail; ½ per cent grade (4.5′x7′ drift).
8. 18-inch, 16-lb. rail; clearance 15 inches to 16 inches. Method mining, spacing of chutes control grade.
9. For hand tramming 18 inches is a satisfactory gauge. Weight of rail 12 lbs. to 16 lbs. Grade one-half of one per cent. Size of drift about 5 feet by 7 feet.
10. No answer.

Q. 58. What is your idea regarding a standard gauge of track, weight of rail, per cent of grade of drift, and dimensions of drift in the clear, for all motor haulage.

ANSWERS:

1. A 24-inch gauge track, 50-lb. rail for electric trolley motor haulage and 30-lb. rail for storage motor haulage, with one-fourth of one per cent grade in all cases. This is to be in favor of the motor. Dimensions of drift in the clear should be 8 feet by 7 feet.
2. Should be the same as for hand tramming, except weight of rail.
3. Same as 57.

4. For motor haulage, it is more difficult to generalize; heavy tonnages in long hauls require different equipment from that used for more general mining.
5. 20-inch gauge, 25-lb. rail, .50 per cent grade. 5'0"x7'3".
6. (a) For main motor haulage to shaft with 10-ton cars, 20-inch gauge, 48-lb. rails; (b) 0.4 per cent in favor of load, 8 feet by 8 feet in clear.
7. Depends entirely upon tonnage to be produced. One-half per cent grade is more suitable grade for driving a drift.
8. 30 inches, 45 lbs., 0.5 per cent, 18-inch clearance.
9. Standards for motor haulage track will vary with size of cars and motors to use same. For general mine use under conditions similar to those in Bisbee, I think a 5 or 6-ton motor is about the correct size. Track should be 22 to 24 inches, gauge weight of rail from 25 to 45 lbs., and grade about .35 per cent. Drift should be 6 by 8 feet in the clear.
10. It may be possible to reduce the number of track gauges, sizes of rail, etc., that are used at present, but not possible to make all of them the same.

Q. 59. What would be your idea of a standard chute, chute door, and clearance between chute and car, also guards on cars, for all hand tramming drifts?

ANSWERS:

1. A 3'x3'9" chute with a 30-degree pitch and a plank gate staggered vertically. There should be a clearance of 6 inches between the chute and the cars. Rods should be provided at the rear of the car for the hands.
2. Our type of chute and chute door as per sketch (see answer 13) are cheaply built and work satisfactorily. Iron arc and side gates of different types have been tried out, but are expensive and are damaged by blasting big rocks. Never less than 6-inch clearance is allowed. Owing to sufficient clearance, have never found them necessary.
3. For cut and fill stopes drawing A.D.-61 represents our idea of standard chute and chute door for hand tramming drifts and motor tramming drifts on all levels except the 700 level. Clearance between chute and car should be 13 inches.
4. For hand tramming ore from chutes, the standard chute in a sill floor set with two gate boards and drip board is satisfactory.
5. Wooden chutes, 24"x24" mouth, wooden stoppers, 12-inch clearance between top of car and chute mouth.
6. See blue print 2-J-520. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
7. C. Q.—Standard chute.
8. See small blue print on hand tramming. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
9. For standard chute (hand tramming) I recommend one similar to that shown on print A-2-C-524. Clearance between chute and car should be 6 inches.
10. No comments, as we have no hand tramming.

Q. 60. What would be your idea of a standard chute, chute door, and clearance between chute and car, for all motor haulage drifts?

ANSWERS:

1. For assembly drifts there should be 3'x3'9" chutes with a 30-degr. e pitch and a plank gate staggered vertically. There should be a clearance of at least 6 inches between the chute and the cars. On the main haulage tunnel the chute should be 2'6"x3' and should clear the car by 8 inches.
2. See answer 59, also answer 51.
3. Same as 59.
4. For motor haulage, the chute described in No. 51 and No. 54 is as good as any.
5. Wooden chute, 24"x24"; iron door with lever or wooden stoppers. 12-inch clearance.
6. See blue print 3-M-17. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
7. C. Q. Standard chute with stronger construction.
8. In questions 56, 57 and 60 it is very hard to specify any definite standard, especially in the larger producing properties, as innumerable features are to be considered with regard to the mining method. The method will control car. These features come under mine methods and timbering. I believe these subjects should be left to the discretion of the Manager and Superintendent, as mining methods are too variable to really specify any particular size of drift, car or chute.
9. The size of chute door will vary with weight and character of material to be drawn out. The door and chute shown in print A-2-A-224 has proved to be very satisfactory for our ores. I believe this general design will make a good standard for all motor haulage drifts. (This blue print is attached to his report, which is also attached to this report, and made a part thereof.)
10. Answers to questions 51, 52 and 54 give our standards which we developed after considerable experimenting.

Q. 61. What is your idea regarding a standard weight of locomotive for use in your mine?

ANSWERS:

1. A 4½-ton locomotive for assembling ore and an 8-ton to 10-ton locomotive for main haulage.
2. We tried first a 3-ton locomotive with trailer battery, but found it too slow and light. We think our present type (see answer 25) to be good, owing to its size and ability to go anywhere a hand propelled car can go, which a heavier and larger locomotive could not do.
3. 5-ton storage battery locomotive.
4. Except for unusually heavy duty, a 6-ton locomotive seems preferable.
5. 3½ to 5½ tons.
6. Our standard is 6½ tons for unit, which is a maximum for 20-inch gauge.
7. 3 tons and 7½ tons.
8. The locomotive which we use is very satisfactory. 6-ton.
9. Our motors (3½-ton) are a little light for our work, but are the largest size that will operate on 18-inch gauge. About a 6-ton locomotive would be about the proper size, I think.
10. 10 tons.

Signed by WILLIAM B. DALY, Chairman.

DISCUSSION OF PROGRESS REPORT OF COMMITTEE ON UNDERGROUND TRANSPORTATION

CHAIRMAN WILLIAM B. DALY PRESIDING

After a general discussion of the Progress Report, Chairman Daly suggested that, in regard to the standardization of mine cars, a motion be made to indicate the general views of those present as regards: First, "the size of car in cubic capacity, taking into account the average specific gravity of the ore or waste to be moved, and the number of cars to a train"; second, "the economical size of a motor to pull that load over a grade (to be established), and which would permit that motive power to pull the same train of empties back on that grade," adding that "this would really standardize the entire motor haulage."

This question, which is at present under discussion by Mr. Daly's Committee, was then discussed pro and con, but inasmuch as it involves so many fundamentals, and the time of the meeting being too brief for such an extensive subject, it was not possible to arrive at any definite decision.

It was, however, the consensus of opinion of those present that an 18-inch to 20-inch gauge, .5 per cent grade, and 16-lb. rail, would meet the requirements for a standard for a medium size drift—say, 5 feet by 7 feet, for hand tramming.

JOINT METAL AND COAL MINING BRANCHES

THURSDAY EVENING, OCTOBER 21, 1921

The meeting, devoted to the subject of Standardization, was called to order at eight-thirty by Colonel Warren R. Roberts, Chairman.

CHAIRMAN ROBERTS: We must first apologize to our audience for delaying the opening of this meeting for half an hour, but we believe that the importance of the subjects to be discussed were worthy of a real audience. We brought men here from New York and Washington to address you on what we consider very important topics, and we hoped by delaying our meeting until about the time people usually go to the theatre, we would have a better audience. Before we begin our regular program, our Secretary has some resolutions to present.

SECRETARY CALLBREATH: I want to announce that at the meeting of members this afternoon, the following gentlemen were elected as directors to serve for three years:

Bulkeley Wells, Denver.
E. L. Doheny, Los Angeles.
Sidney Jennings, New York.
H. W. Seaman, Chicago.

I might say that our Board of Directors consists of twelve members. The effort is made always to have them distributed as nearly geographically as possible to cover the nation and at the same time so as to represent as nearly as may be the different branches of the mining industry.

I want to read, as the by-laws require, a few resolutions as presented.

Secretary Callbreath read Resolution No. 8, presented by Mr. A. G. McGregor; Resolution No. 9, recommending that the increase in freight rates on railroads be abolished; Resolution No. 10, introduced by the Tariff Conference; Resolution No. 11, on Americanization; Resolution No. 12, by the Tariff Conference.

CHAIRMAN ROBERTS: You will notice, by referring to your programs, that this is the Fifth General Session of our Convention, and through the courtesy and the generosity of our convention management, the session is to be devoted to Standardization.

As an introduction to the subjects which the speakers will discuss this evening, I think a word of explanation as to our understanding of the meaning of standardization would not be out of place.

As I remember, the motto of the American Mining Congress is "Safety, Efficiency, Conservation." These are the ideals which the American Mining Congress has been striving to attain, since its organization. However, until the Standardization Division was organized, the American Mining Congress had no machinery set up exclusively to attain these ideals.

Standardization in its proper interpretation and application fulfills the ideals of the motto of the American Mining Congress.

You are all familiar with the meaning of the word "safety." We have had campaign after campaign to teach our people the great value of safety.

Efficiency is the watchword of our great industrial organizations. Therefore, you are all familiar with what efficiency means. It has doubtless been the greatest factor in creating our great industrial concerns.

Conservation is a very broad term often misunderstood and misused. It was first given national importance by the great American, Roosevelt, and since he made "conservation" popular with the American people it has had many followers.

Those are the three ideals of the American Mining Congress, and the Standardization Division is trying to realize those ideals for the mining industry

You will note, as the speakers of the evening come before you one by one, that they are all young men. There is an old motto: "Young men for war and old men for counsel." This is not exactly war, but it is a great campaign, and a campaign is a part of war, and this program tonight is a part of our campaign. We have, therefore, selected our young fighters, and I hope they will be as full of "pep" tonight as they have been in the past in helping to win other victories.

Some years ago there was a great article written entitled, "A Message *to* Garcia." I understand that that message has been translated into more languages and read by more people than any other document that was ever written. Tonight we are going to have a message *from* Hoover. I hope that this message will be as important to American industry as the message to Garcia.

The messenger who has been selected by Mr. Hoover to bring his greeting to the American Mining Congress and the people of Chicago is Mr. H. C. Morris, Chief of the Fuel Division of the Bureau of Foreign and Domestic Commerce. We will now hear the message.

CO-OPERATION OF THE DEPARTMENT OF COMMERCE WITH THE MINERAL INDUSTRY

MESSAGE FROM SECRETARY HERBERT A. HOOVER PRESENTED BY H. C. MORRIS

Mr. Chairman, Ladies and Gentlemen of the American Mining Congress: I bring you a message this evening from one of our own kind, whose broadness of vision and sureness of accomplishment have made of him not only a mining man of international repute, but also a humanitarian whom the whole world holds in affectionate regard and is proud to honor, the Secretary of Commerce, Herbert Hoover.

Mr. Hoover asked me to say to you that the Department of Commerce is charged, under act of Congress and by virtue of the desire of the Federal Government to be generally helpful, with the stimulation of the distribution of commodities. The mineral production of the United States is, therefore, a matter of keen interest to the Department and one in which it has the greatest anxiety to be of service.

The Department is *not* a regulatory Department, but a Department of service. Its functions, so far as they are developed, are largely in the direction of the promotion of foreign trade, the furnishing of statistical information both foreign and domestic, and the conduct of investigation work in the great physics laboratory of the Bureau of Standards.

Except for a few of the metals our export trade in mineral commodities is indeed badly disorganized, and it is with the purpose of assisting the industry to better this organization that we have reorganized the Bureau of Foreign and Domestic Commerce and installed in it a Fuel Division. We hope to be

able also to establish divisions to directly assist the business in other minerals.

It is the desire of the Department to co-operate with the great voluntary bodies of the industry in the development of this service, for the Department is endowed with agents in almost all quarters of the world and is able to develop facts with regard to supply and demand, and to assist the American exporter in the actual negotiations of his business.

Success in selling, whether at home or abroad, is founded upon an accurate gauging of buying ability; and that, in turn, must of necessity be based upon accurate and prompt information of general conditions in the market centers of the world, and upon specific conditions of competing foreign industries.

In statistical information the reorganization of the Bureau of the Census, to cover a wider field of live and current statistics, is of profound interest to the mineral industry; not only because that industry depends considerably upon the trend of other industries, but also because statistical information of consumption in the industry itself falls far short of satisfying the necessities of the business.

In the reorganization of the Bureau of Standards to include the wide theme of manufacturing standardization and simplification, the Department again comes into relationship with the mineral industry.

For all these reasons it is the keen desire of the Department that it should be brought into closest relationship for co-operation with the industry, and it seeks the appointment of a committee from your Congress, which will co-operate with the Department.

The mineral industry of this country should gain a position in the world's trade commensurate with the abundant resources of the United States. We must develop a spirit of mutual helpfulness and co-ordination of effort in order to meet the competition of organized commerce abroad, and with that purpose in view, I pledge you the full assistance of the Department of Commerce.

CHAIRMAN ROBERTS: I am sure that you will all support me in extending to Mr. Hoover through his messenger, our very hearty appreciation of his message to us, and that we will undertake immediate and careful consideration of the suggestions contained in his message.

We have heard a very great deal of late, much has been written and bills have been introduced into Congress with the object of trying to stabilize the coal industry, as they put it. There are many doctors offering a cure for the supposed ills of the coal industry, but no suggestion has been made to date and no bills have been introduced in Congress that seem to meet the requirements of this case of stabilizing the coal industry.

We are now going to have an address by Mr. C. E. Lesher, Managing Editor of "Coal Age," the greatest coal journal in America. He will speak on "Standardization as a Factor in Stabilization of the Coal Industry." (Applause.)

STANDARDIZATION AS A FACTOR IN STABILIZATION OF THE COAL INDUSTRY

BY C. E. LESHER

Mr. Chairman and Gentlemen: Intelligent conception and application of standardization spells progress. The narrow view means atrophy. Standardization must be viewed broadly, not as an effort to reduce all to a common denominator. The accepted creed of labor unionism that standardizes individual effort and initiative by setting maximum standards of performance is nothing short of vicious. No less vicious is any effort to set standards of profit in business, standards having no regard to service performed. Less than a year ago in an address before the American Economic Association at Atlantic City, Mr. George Cushing said that as the managing director of the American Wholesale Coal Association, probably better known to you as the coal jobbers, he had been studying the marketing of coal and in two years had got no further than to consider the advisability of having a fixed return to the jobber and that the figure then thought best was 50 cents per ton. That is not the kind of Standardization we want.

If instead of setting standards of maximum effort that prevent the rise of able men, strangle competition, and stifle initiative, the labor unions would standardize on minimum effort, they would be more in keeping with the spirit of our conception of social justice. A phrase as yet not satisfactorily defined is "The American Standard of Living." You may well conceive to where we would come were we to seriously consider that living conditions could actually be standardized, the same for every individual. Yet there are and should be, certain aspects of living conditions that are properly to be considered as subject to standardization. So it is with mining coal. We may properly fix upon the pitch or thread for a screw of given diameter, but we must not attempt to say that only screws of certain diameter must be used. Rails are quite properly manufactured in a series of weights per yard; but standardization in the use of rails that goes beyond the definition of the maximum moving load that should be carried on rails of each weight, is misapplied.

We may have the room and pillar system of mining as a standard form, but we must not attempt to define the width of all rooms, and the thickness of all pillars. Conditions at each mine and often in different parts of the same mine control these things. In other words, in the mechanical processes of mining it is the standardization of broad principles of methods and practices that we seek rather than narrow details. As I have watched the development of the program of the Standardization

Conference here this week I have been impressed with the sound reasoning that is back of its direction. Petty details are brushed aside and thought has been directed toward the big things. Mining engineering in the coal industry in this country has advanced far in the direction of use of machinery for the purpose, as Director Smith so aptly put it yesterday, of product increasing rather than narrowly, of labor saving. The high broad conception of standardization held by Col. Roberts, the chairman and guiding spirit of this movement in this Congress and Conference, is leading you in the direction of progress.

But standardization need not be confined to the mechanical and mining engineering aspects of coal. It has already taken a large part in your relations with labor. Wages are standardized. I think none, even the most partisan non-unionist, but will agree that the standardization of wages effected by the contract between the operators and the labor union through some 25 or 30 years of collective bargaining has benefited the coal industry. It has stabilized the industry; it has even in the past stabilized strikes, and put them in the even years and at a certain time in the spring. For these benefits, if for no other, and despite its failures, I never expect to see the abolishment of collective bargaining in the coal industry, though its form and animating spirit and program of nationalization must be greatly amended and changed.

It is perhaps significant of the fact that labor is the largest problem of the coal industry, that standardization has proceeded farther here than in any other aspect of the business. Contemplation of its application may help us to more clearly see where such a program will lead us in attempts at standardization in other directions. In the first place we find base rates that govern over all the producing fields, union, of course, and ultimately non-union as well. But the standard wage is not the wage for all. There follow differentials in fields, predicated on differences in underground and even on market conditions. Finally the standard wage is not applied to each mine and further than that, to each working place. Deficiencies command a bonus, unusually attractive working places attract the most efficient labor. Standardization of wage has been a great asset to the coal industry; it is only with the arbitrary attempts of the union to standardize individual effort and prevent progress that we have serious quarrels.

It is somewhat as if the manufacturers of machinery should organize a tight union and dictate to coal operators the kind of equipment they should use and also just how, when, and where, it should be used. They might in some instances improve on prevalent practice, but in the long run the result would be retrogression and increased cost, because such a course would be contrary to the priniciple of individual freedom and enterprise.

The largest undeveloped area in the coal industy in which

standardization is yet to play a substantial part is that of marketing, and it is here that lies the richest opportunity for stabilization of the industry. Fundamentally stabilization means leveling off the peaks in production and price and filling up the depressions. It means giving uniform employment to men and to capital engaged in the production and distribution of coal. In one branch of the industry, that of mining anthracite in Pennsylvania, that condition has been very closely approached. Steady price levels for the principal product of the hard coal mines and comparatively steady rates of production have been reached through standardization of product, that is by setting up definite sizes, and by standardization of prices. In neither quality, size or price is there positive uniformity, but the variations are minor as compared with those obtaining in the bituminous coal trade. The approach to uniformity has been sufficient, coupled with a standard method of merchandising, to produce for the anthracite industry a degree of stabilization that is the aim and ambition of the soft coal trade.

The inherent difference between the anthracite and bituminous coal industries make the approach for the latter more difficult than those confronting the hard coal operators in 1902, when they initiated the program that has been of such a benefit to them and the consuming public. Instead of a compact area with relatively few producers as with anthracite, bituminous coal is widely scattered, of greatly differing qualities and grades and in the hands of thousands instead of hundreds of producers. Instead of catering to but one primary trade, the household user, the bituminous is the fuel of all industry and transportation as well as of the home.

The first step in standardization of marketing relates to quality and preparation. The next is education of the buyer and consumer in these standards. An outstanding illustration of what can be done in this direction is found in the development and operation of the pools in the coal trade on the Atlantic seaboard.

In less than three years classification of eastern coal by pool number has become so well established as a feature of the trade that despite the fact that the exchange handling the business has been discontinued, the trade continuing to quote coal by pool number and the buyer continues to think in terms of coal by pool. Pool 1, for instance, has come to have a definite meaning as regards quality, a meaning accepted by seller and buyer alike. This simplified business in that coal. Producers of large tonnages with well established names are able to carry on without the organized assistance of such a system of standards and have therefore largely operated outside the voluntary tidewater coal exchanges, whereas to the smaller producer, the organization has been a great help in marketing.

The ultimate development in this direction is found in the form of exchange adopted by the shippers of coal on the Vir-

ginian Railway in the smokeless field of coal produced in their area, classified their product in terms of ash, sulphur, volatile matter and heat value and in their tidewater business are able and do guarantee the quality of each shipment. And because they collectively are able to give such guarantees there, operators have through this form of standardization, stabilized their market.

Not every field is so favored of Nature. However, as the smokeless of West Virginia, Central Pennsylvania, for instance, presents such a myriad of varieties of coal as defy such definiteness of classification. The answer here, of course, is to split up Central Pennsylvania into logical units of small producing areas and standardize the product from each district. Where the classification of coal in this area has so far failed is in not defining standards.

It has been proposed to classify all coal produced and to assign each mine to some class. It has even been proposed that the Federal government should inspect all coal shipped in interstate trade and give guarantee to the consumer, as it were, as to the quality of what he is buying. We may perhaps, some day come to this, for as the advocates of this proposal point out, other basic commodities, as wheat, are already so handled.

The fact that such a scheme finds advocates is evidence, not to be overlooked by the shipper of coal, of the need and desire on the part of the consumer of coal for some sort of standardization. Perhaps the most we can hope for in this respect over the greater part of the bituminous coal field is standardization of sizes. Standardization in quality is more difficult of approach because what is poor coal for one purpose may be the best coal for some other use. What is needed then is standardization of use, the determination of the kind of coal, taking into consideration both chemical analysis and physical properties, that is most suitable for each boiler plant and for each process. As may be expected the consumer is taking the lead in that direction, the National Association of Purchasing Agents only recently having taken up the question of standard specifications for the purchase of coal.

In the matter of contracts governing the purchase and sale of coal, there is great need for standardization. The crying need here is for a revolution that will make the coal contract a binding document. This result cannot be achieved simply through the process of drawing up a legal paper; it must come through a change in the method of selling coal. When the coal shipper is in position to bind himself to deliver under all and every circumstance the coal he sells, then he will be in position to require of the buyer a guarantee that he take under all conditions the coal that he has purchased. We cannot complain that this angle of coal marketing has not been standardized. On the

contrary the practice of holding a coal contract merely as an option to sell or buy is altogether too common.

Taking the broad view of standardization and the practical view of stabilization, the question may be summed up by saying that the possibilities of the one for bettering conditions in the coal industry are great enough to warrant their intensive study and application by all seeking the other.

CHAIRMAN ROBERTS: In preparing these programs for the Standardization Conference, much care was exercised in trying to produce a well-balanced and constructive program for each session. Therefore, in preparing one of our programs we decided that it was very essential that we should have an address on the subject of "Standardization as a Factor in National Defense." Some of us who are familiar with the methods used in the great central work at Washington, in trying to supply our armies in the field with all of the necessities of warfare, know that standardization at that time was a real factor in winning the war. We, therefore, believe that it is appropriate to include in our program an address on this subject. We requested the War Department to send representatives to attend our standardization conference, and that one of these representatives should give us an address on this subject. We requested that they send Col. George S. Gibbs of the general staff, and after a great deal of effort and correspondence, they advised us that the regulations did not permit it. We were, therefore, under the necessity of going up to the Secretary of War and getting permission for Colonel Gibbs and Major Ward to attend these conferences of the Standardization Division and for Colonel Gibbs to give us this address.

It is an old axiom that we value the most for which we have had to strive most. We, therefore, have great satisfaction in this opportunity to hear from the War Department on "Standardization as a Factor in National Defense." The man who will address us is a soldier—and soldiers, you know, are rated only according to their qualifications for fighting. Colonel Gibbs has a most enviable record as a fighter, as is indicated by his decorations. I do not want to embarrass him by my remarks, but these bars may not mean a great deal to you, not understanding them. If they were replaced by the decorations they represent, he would wear eleven national decorations, including one from the King of Belgium, one from the President of France, one from the King of England, one from the King of Italy, and all of the balance from the United States Government, including the Distinguished Service Medal. So he is a real soldier. (Applause.)

Col. Gibbs had a great deal of hesitation in coming before our organization and making an address, but we persuaded him to do so, and we are very grateful that he is here. Col. Gibbs. (Applause.)

STANDARDIZATION AND NATIONAL DEFENSE

By COL. GEORGE S. GIBBS

Mr. Chairman, Members of the Conference: The Secretary of War has directed me to express to you his deep interest in the great work of standardization and to assure you how thoroughly its importance is realized by the War Department.

The Assistant Secretary, Colonel Wainwright, upon whom Congress has imposed supervision of the business features of the War Department, is not only an enthusiastic supporter of standardization, but may be depended upon to apply its prin-

ciples in a practical way wherever it can be done. If it had been at all possible for him to have come out here at this time to address you, he would have given you those assurances in person.

During my attendance at the sessions of this Congress, both old friends and new acquaintances have said: "How does it come that *you* are attending a mining congress?" and "What is the interest of the *War Department* in standardization of articles connected with the mining industry?"

If I shall be able to tell you—and show you—how tremendously vital standardization, in its broadest application, is to the War Department, I will have fulfilled my mission here.

As we look across this broad land, and about the city in which we have gathered, the things that impress us most are the institutions that represent the growth and progress of our civilization. They are built of iron and stone and all manner of things that man has turned to his uses. They include family and social and civic standards and relations that represent generations of painstaking cultivation. Were all this wiped out, who knows whether or not it could ever be restored or how many centuries it would take in the rebuilding?

WHY NATIONAL DEFENSE?

In order that it may progress along its course of destiny—in order even to survive its alloted time—this great Nation of ours must protect what it has gained. It must guard what it has built, and secure the freedom and opportunity to grow and build and live. That is *National Defense.*

Those rights and opportunities may often be secured, up to a certain point, by diplomacy. But always when the issue reaches the stage of survival or extinction, the right to survive can only be assured by relying upon that second stage of diplomacy—the force of arms.

THE ESSENTIAL NEEDS OF DEFENSE

The essential needs of defense are men and supplies, or personnel and material. The men must be trained and have the will to win. The supplies must be suitable for their uses and adequate in quantity. That is where *standardization* comes in. It represents the difference, on the one hand, between being able to get the needed quantities of uniform articles of tested usability, and on the other hand, of being restricted and harassed by a hodgepodge of varieties the usable quantities of which are always insufficient.

IMPORTANCE OF STANDARDIZATION

The importance of standardization of war supplies cannot be exaggerated. In these days war involves the united effort of

an entire Nation and the combined employment of all of its principal industries. How is it possible to harmonize the use of thousands of articles to a common end except by the adoption of a far reaching and effective program of standardization?

Perhaps the most crying need for standardization is in machines—machines for making articles, and particularly machines for making other machines. Those of you who buy and use machinery are only too well aware of the truth of this statement, and this brings up the question of a foolish and wasteful conflict that is the greatest enemy of standardization.

THE FIGHT BETWEEN "INDIVIDUALITY" AND STANDARDIZATION

Just after the Spanish War, more than twenty years ago, a determined effort was made to bring about the adoption of standard containers for medicines. Types of bottles were devised that were ideal from every standpoint. Measures were blown in the glass at no additional expense, and the shapes were right for economical and safe packing. Their adoption was resisted by the big manufacturers, who insisted upon putting out their product in hundreds of varieties of bottles of peculiar and distinctive shapes. It is needless to point out the wastefulness of this practice, and I believe that it is equally misguided, as it should be possible to make labels and wrappings that would serve the purposes of individuality and attractiveness.

The Government once bought meteorological instruments from a maker who purposely used a foreign screw thread, so that simple brass screws needed for repairs had to be bought from him, and him alone.

A certain manufacturer of shoes in this country recently reported that he had in current use more than ten thousand different shoe lasts. Five hundred lasts, or one twentieth of that number, would provide shoes to fit every man, woman and child in America, and allow several styles for selection.

Manufacturers are today paying large salaries to clever men whose sole mission is to produce articles and variations of articles that are utterly different from those obtainable elsewhere, the use of which cannot be combined with the use of any other article.

As a money-making proposition, this is of doubtful utility. In the larger markets of the world buyers cannot afford to purchase articles that become useless unless a single, distant maker can be reached.

These examples will appeal to you from a business standpoint. From the standpoint of National Defense the use of non-standard articles produces incalculable waste of money, and what is worse, it wastes time that is precious and jeopardizes the success of an effort upon which our very existence may depend.

The fight against this thing is your fight, both as business men and patriots, and to make headway you will have to be very aggressive and very industrious.

It is not to be expected, nor do you want your Uncle Samuel to go so far in paternalism, as to take this matter out of your hands.

Right here I wish to add an observation that has come to me during my attendance at these conferences.

I have been impressed with the earnestness and enthusiasm of some of the Committees and their members. They are undertaking work that they can ill afford the time to do, and generously propose to continue it. But, it seems to me, this method of procedure alone will not produce results as fast as the need for progress in standardization demands. This volunteer work is all right—it is needed especially because it enlists the participation of the men who know the industry and its needs better than any others, and whose services cannot be hired.

Should this not be supplemented by a small professional standardization group that will devote 100 per cent of its time to that work, co-ordinating and speeding up the work of committees and sponsors, and getting actual results in a few weeks that would otherwise take two or three annual congresses to complete? What do you suppose the American Engineering Standards Committee would accomplish if it were not for Dr. Agnew, the Secretary, and his very limited office force?

On seeing the scope of the work undertaken by the Mining Congress, I asked why that body was doing it instead of the Institute of Mining Engineers, and was told that the Mining Congress had taken it up because the Institute of Mining Engineers had not accepted it as its responsibility and was not making headway.

What body does it is not so important, but it is necessary that all of the work shall head up into one controlling center, and that there shall not be division and pulling at cross purposes.

Either one body should do all the work, or complete co-operation effected.

HOW THE WAR DEPARTMENT DOES IT

Since writing this I have, of course, listened to Col. Roberts' statements or explanation of the correlating committee. They do, in a measure, cover what I have pointed out in these remarks, but they do not cover the one feature that I tried to bring out here, and that is of having a secretarial or professional standardization crew on the job to work night and day, if necessary, so as to get results so that we can have them while some of us still live rather than in the far distant future.

The War Department is not only supporting the efforts toward the adoption of national and international standards, but has gone much farther. The Secretary of War has directed that

American Standards, when adopted, shall be incorporated in all specifications of articles of supply to which they pertain. He has also directed that in the adoption of articles for military use, the standard articles of commerce will be selected when they are at all suitable for the purpose, and that special types be avoided whenever possible.

In this connection, I wish to say that before we went into this war you could have taken a thousand-dollar bill in one hand a galvanized Q. M. bucket in the other, and you could have gone through this country and you couldn't have gotten a galvanized bucket according to the government specifications—not one—with your thousand-dollar bill. Of course, the War Department was at fault in having an article so special as that. On the other hand, the industry was equally at fault because when we had to have buckets in larger quanties we went out and tried to get them, and there weren't buckets that were at all suitable in sufficient quantity to supply anywhere near the demand.

The organizational arrangement in the War Department for determining types of articles of equipment and supply and for preparing specifications therefor is rather cleverly worked out and I am sure that it will interest you.

First: The users, the troops themselves as represented by the Chiefs of the several arms, make known what they want. Conflicting views are co-ordinated by the General Staff.

Second: The Chief of the supply branch responsible for procuring that class of article has the research and engineering work done and samples prepared. The type receives final approval by the Secretary of War and the article is prescribed in equipment tables.

A SYSTEM OF AUTOMATIC CO-ORDINATION

The final preparation of the specification that becomes the basis of procurement is the responsibility of the Chief of the supply branch. Each such branch has a technical committee charged with preparing and carrying out a definite program of preparing specifications of all articles procured by that branch. This is a task that will take years to complete.

A representative of each using or interested service meets with this committee in order to see that the interests of his service are taken care of. When complete agreement is reached, the Chief of the supply branch may approve and publish the specification without further action or approval. If there is a disagreement, which rarely occurs, the matter is sent to the General Staff for adjustment.

As you doubtless know, there are seven Supply Branches of the Army. The Quartermaster Corps procures all equipment and supplies for its own activities, and all general supplies of a